# American Farming and Stock-Raising

Manly Miles

# AMERICAN FARMING

AND

# STOCK RAISING,

WITH

## USEFUL FACTS FOR THE HOUSEHOLD,

DEVOTED TO

FARMING IN ALL ITS DEPARTMENTS, INCLUDING ROTATION OF CROPS, DRAINAGE, FERTILIZERS, ENSILAGE, THE DAIRY, ORCHARD, VINEYARD GARDEN, DOMESTIC ANIMALS, THEIR BREEDING, MANAGEMENT, AND DISEASES; BEES AND THEIR MANAGEMENT, FISH CULTURE, SILK CULTURE, ARCHITECTURAL DESIGNS FOR HOUSES AND OTHER FARM BUILDINGS, IMPROVED SANITARY CONDITION OF COUNTRY HOMES, ETC., ETC.

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WITH

AN APPENDIX

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TO

HON. MARSHALL P. WILDER,

PRESIDENT OF THE AMERICAN POMOLOGICAL SOCIETY.

THE ENLIGHTENED AND LIBERAL FRIEND AND PATRON

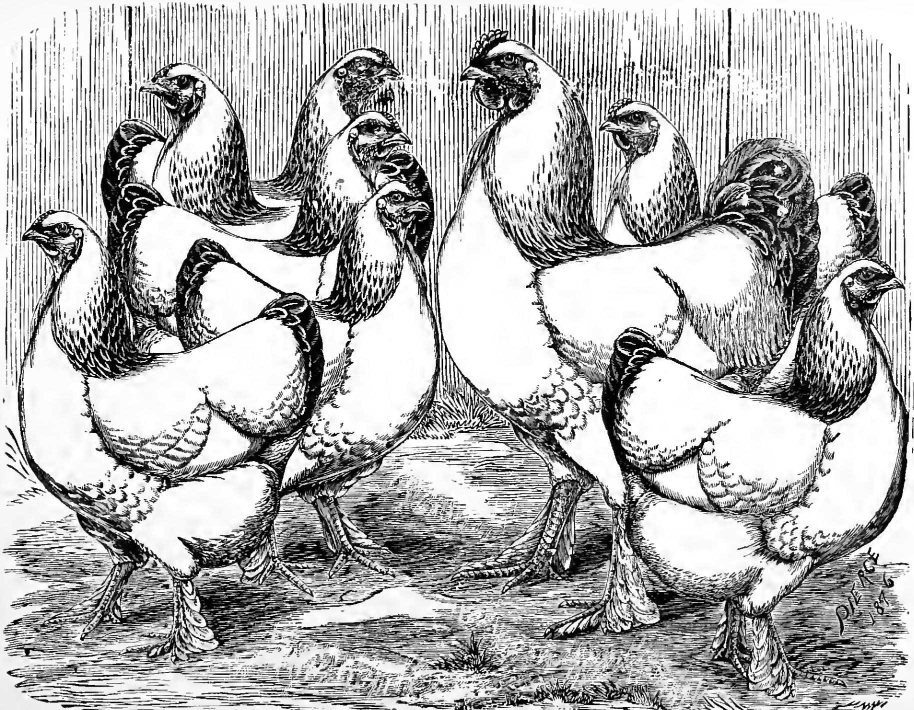
OF

AGRICULTURAL AND HORTICULTURAL PROGRESS IN AMERICA,

This Work is Respectfully Dedicated

BY

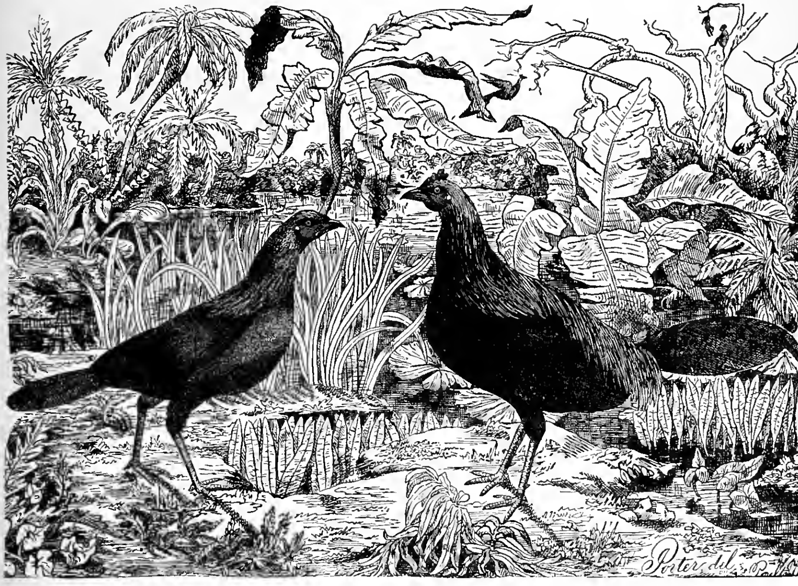
THE AUTHOR.




LIGHT BRAHMAS.
Bred by I. K. Felch, Natick, Mass.

# POULTRY.

THE term poultry may be defined as meaning all domesticated birds (Gallinacea), such as the common fowl, the Guinea fowl, the turkey, and the pigeon; and palmipeds, as the duck and goose, as far as they are reared for useful purposes. The word poultry comes from the Latin word *pullus*, which means a chicken, or the young of any animal. The modern word poultry, however, may be said to more properly come from the French word *poule*, signifying hen; the word pullet being derived from the French *poulet*, a chicken. In the modern sense, the word poultry is more generally applied to the genus *gallus* or barnyard fowls, the word fowl being used with a prefix, to denote other species, as water-fowl, which applies to ducks and geese, Guinea-fowl, etc., while turkeys, peacocks, pheasants, etc., are usually designated by their particular name.

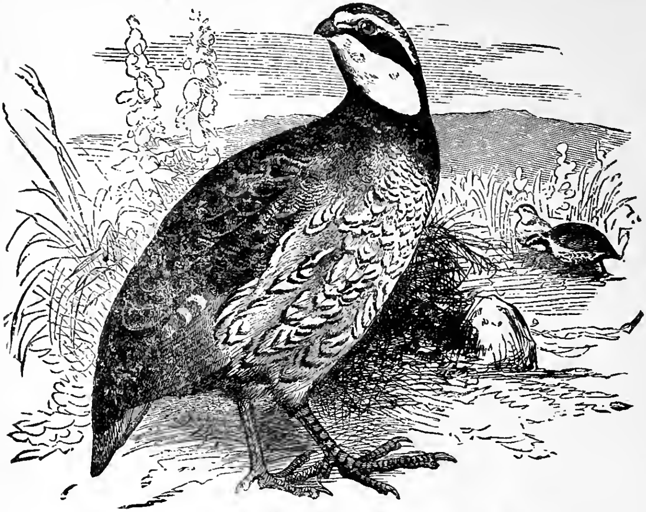


GALLUS BANKIVA, OR WILD JUNGLE FOWL.

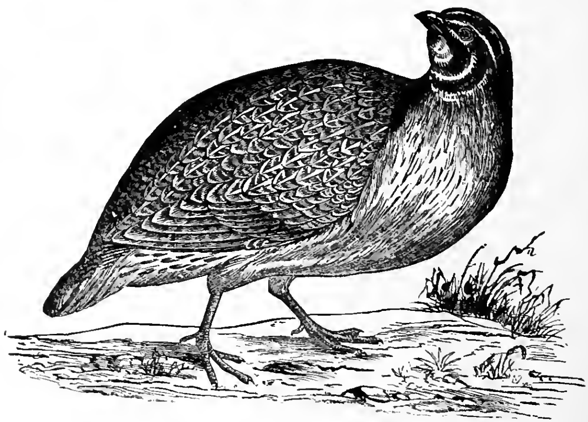
For sixty years or more enterprising breeders of poultry in this country and England have been endeavoring in various ways to improve the domestic fowl, forming new breeds for this purpose, domesticating wild birds and importing new races already domesticated in other countries.

Many foreign breeds have in this way been widely disseminated, such as the Asiatic fowls, the Aylesbury, Rouen, and Pekin Ducks, the Toulouse, Hong Kong, and Bremen Geese, the Bronze Turkey, etc. There still remain, both in this country and Europe, many desirable kinds of native fowl which might easily be tamed and made valuable breeds for domestic use; and it would not be strange if a few years' glimpse into the future would show us many

varieties in common use that are now only known as wild fowls, such as the Black, the Canvas-back, the Wood Duck, the various kinds of Wild Turkeys, Geese, Pheasants, Quail, the Prairie Hen (known as the Pinnated Grouse), the Partridge, etc., all of which a few genera-



AMERICAN QUAIL.



EUROPEAN QUAIL.

tions of domestication would improve in size, quality, and fineness of flesh, as experience has shown with our domestic fowls of to-day.

It is a well-known fact among bird fanciers and breeders of the wild fowl, that none of the large domesticated breeds of ducks were in a wild state larger than the average Canvas-

back duck or Mallard, but by long domestication are found to be one-third or half as large again as these are at the present time.

It is generally admitted by ornithologists that our domestic fowls are descended from the wild jungle fowls of the East Indies. The various species of the Game fowl still retain much of the form, color, combative propensity, and courage of this wild species. The Jungle fowl, known as *Gallus Bankiva*, resembles most of all the wild varieties our common Black-red Game, and that fowl is regarded as the immediate parent of this variety, from which so many sub-varieties have been bred by selection or crossing with others.

**Intelligent Supervision essential to Success in Rearing Poultry.**—Of all poultry, hens are the most easily and numerously reared, and also most profitable; producing a larger supply of eggs than any other of the feathered tribe, since they are peculiarly an egg-producing bird, having the same predisposition for laying that the cow has for milk secretion, and while some breeds are better adapted for laying than others, still our experience has taught us that all breeds, under proper and favorable circumstances, will produce a reasonable supply of eggs; and these favorable circumstances are,—a good house to roost and lay in, proper ventilation (without which no animal whatever can thrive or be perfectly healthy), cleanliness, a variety of suitable food, plenty of pure water to drink, sunlight at all seasons, suitable warmth in winter, and a reasonable extent of range and exercise, though some Asiatic breeds, like the Brahmas and Cochins, will do well for a long time with limited range, as they are naturally of quiet habits and disposition.

Due attention to these items will, we have no doubt, insure good success and fair remuneration from any of the well-known or common breeds of fowls, remembering that quite as much depends upon the care received as the breed, in the results obtained; and here we would say with emphasis, to impress its importance in securing success, that fowl rearing, like all other business, in order to be *profitable*, should have *personal care and supervision*, and *not* be left to the care of domestics, as in that case, even from the best and most trusty of them, the attention would, as a general rule, be inadequate to good results, and disappointment would be the consequence.

Intelligent supervision and personal attention are the essentials to success in poultry raising, and unless that supervision and attention can be given, we would not advise any one to attempt to engage in the undertaking.

**Pleasure and Profit Attending Poultry Raising.**—Much pleasure, as well as profit, may be derived from the care of poultry; they engage the sympathy and interest, and have a tendency to awaken the kindliest feelings of our human nature, which, if rightly matured and cultured, cannot fail to make us more humane and close in sympathy with all created and living things; besides, but little time, comparatively, need be spent in these duties, where the arrangements for their keeping are what they ought to be, for health, comfort, and consequent profit; while with the use of a little ingenuity, this may all be done without soiling so much as even the fingers. It is well for children, in the influence derived, to have the care of something; it calls out their affectionate interest, and makes them more considerate and gentle in their treatment of inferior animals, and if there be children in the family old enough to be entrusted with these duties, they will derive much benefit and pleasure by attending to what will soon become their pets; for, with kind and gentle treatment, all fowls will soon become tame and fearless of those about them.

In France, and some portions of England, it is customary for the ladies of the household to have charge and personal care of the poultry, and we are glad to know that in this country the practice is not entirely unknown, though it is not as common as we might wish. We believe if this custom were more general with American ladies, there would be less complaint and criticism among physiologists on account of their early loss of beauty and

health for lack of out-of-door exercise. With regard to the scope for the exercise of the æsthetic perceptions in such employment, a recent writer has well said:

"We can assure the ladies that in this specialty there is great scope for the exercise of æsthetic perceptions. What can be more beautiful, for instance, than the penciling of the gold and silver Hamburgs; the exquisite harmony of color which the best-bred Gray Dorking pullets exhibit, and which we think come nearer the wild game birds of the country in beauty of form and plumage than any other?

Then there are the numerous strains of game fowl, the *preux chevaliers* of their race, unexcelled in splendor of plumage and unequalled in grace of form and carriage; the Houdans, helmeted like cuirassiers, and the plumed Crevecœurs, the *black-horse cavalry* of the poultry yard; the La Fleche with its branching antlers, and the black Spanish and Leghorns, whose battlemented combs of the brightest crimson, flaming above the raven and snow of their plumage, entitle them to be considered the *color guard* of the grand poultry army. Then there are the stately Brahmas and Cochins, the giants of their race; the black Polands with their crowns of snow, and their golden and silver cousins beautifully marked; and last come the sprightly little Bantams, whose pencilings have made immortal the name of Sir John Sebright, and whose tints are almost as various as the wild flowers of spring. Is there not a field here sufficient to tempt the most æsthetic taste?"

The pleasure afforded by this employment,—the health derived from the consequent out-of-door exercise, would well repay any lady for undertaking the task, to say nothing of the pecuniary profit to our farmers' wives and daughters, that with proper management would certainly result therefrom, and thus a very desirable amount be added to the yearly supply of "*pin money*," which sometimes fails to meet all the demands made upon it. We know of no employment that yields so large a per cent. of profit, with so little care, as poultry raising, whether for eggs, market, or for sale as fancy stock.

**The Best Breeds of Fowls to Keep.**—There is probably no question regarding poultry, more common, or more perplexing than, "Which are the best breeds for general purposes?" since so many of the popular breeds have each their advocates, who give them the first choice as their especial favorites, and urge claims to equal points of merit. We find it true in almost all instances, that where a breeder has been particularly successful with some especial breed or breeds, choice will lie naturally in the direction of his success, while another might be equally fortunate with a breed entirely different, and urge his claim as strongly in favor of that particular breed.

In the selection of a breed of fowls, many things must be taken into consideration, such as the situation, the range, the character of the soil, the object which the purchaser has in view,—whether production of eggs or poultry. If there be plenty of range, with eggs the main object, the Leghorns, Plymouth Rocks, Houdans, Game, and Hamburg varieties will be found among the most profitable. Hamburgs are exceptionally good winter layers, and are said by some breeders to produce more eggs in a year than any other breed, as they are non-sitters and lay almost every day, except when moulting; their eggs are, however, rather small, while the fowls must never be crowded, and must be kept with *very clean surroundings*, as few breeds suffer so much by overcrowding, poor ventilation and filthy conditions as the Hamburgs. As winter layers, the Plymouth Rocks have few equals, and no superiors. If however they are confined and fed exclusively on corn, they are apt to become so fat as to seriously interfere with their laying. They require a good range; at least an acre of grass to every twenty-five fowls. If the range is limited, Brahmas, Cochins, and their crosses will be most profitable, and even whether the range be limited or not, the Brahma has few equals in laying qualities; but care must be taken, as with all fowls, that the food consist of variety, and not exclusively corn.

Where the soil is heavy and inclining to be damp, the Dorking, Black Spanish, and

Poland varieties will be found especially unprofitable, since with these conditions they would be liable to roup tendencies. The Spanish lays well in the spring and summer, but is regarded by many as a poor egg producer in winter; the eggs are, however, very large and delicate in flavor. The Poland varieties are prolific layers, non-sitters, and their flesh is remarkably good, but their great fault, as we have previously stated, is a tendency to roup, being easily affected by the cold, dampness, or bad weather.

If the object of the purchaser in the choice of fowls is the meat quality, or the production of poultry, we can recommend no better breeds than the Dorkings, Houdans, and Brahmas. The Dorking, which is regarded with so much favor in England, and is the favorite fowl in the London market, has probably no equal as a table fowl; its fineness of meat fibre, and delicate flavor, have placed it first in this respect, though it is not a very desirable fowl for egg production. The chickens, however, are very delicate in constitution, and sensitive to cold or wet weather, and in consequence should not be hatched before May, and should be kept where the soil is dry, with plenty of range.

The Houdans nearly equal the Dorkings as a table fowl, are extremely hardy, good layers of large-sized eggs, making them in all respects a very desirable fowl for the farmer. They will bear a moderate amount of confinement, but never sit; consequently when keeping them it will be necessary to keep a few hens of some other breed,—Brahmas, for instance,—for purposes of incubation, unless an incubator be used for hatching chickens artificially. Brahmas are quite hardy, grow rapidly, and make an excellent table fowl, as well as an egg producer.

J. K. Felch, Esq., of Natick, Mass., one of the best-known poultry breeders of this country, furnishes us the following for this work, as his opinion on the comparative merits of different breeds of poultry:

"To write of the comparative merits of different breeds of fowls cannot fail to run in opposition to the opinions of many breeders, for the reason that, as a rule, men follow the bias of their own individual taste and fancy on the subject of poultry keeping. as well as other matters; consequently, they are especially interested in their choice, and the fowls get excellent care, which results in a good profit to the breeder, who, being more than satisfied with his experiment, straightway votes the breed *he keeps* as 'the *best.*'

To say what we know upon this subject, in the fewest words, we will briefly mention a few of the merits and defects of different breeds in the order of their respective excellence, as we regard them.

Of all the Asiatic class, Light Brahmas must be acknowledged as being the most perfectly bred. A large number of the chickens reach ninety or more points as show birds; besides, they are the best winter layers, and more apt to lay through the moulting-season than any of the large breeds. Their eggs bring from five to seven cents more per dozen in the market than do the eggs from the small breeds. A Light Brahma hen will lay one hundred and fifty eggs, and hatch and rear a brood of chickens in a year; the chicks make nice broilers at from eight to ten weeks of age, and retain the tender and juicy excellence of meat quality as roasters from eight to thirteen months of age.

Their demerits, as we regard them, are a tendency to over-fat, as fowls, which necessitates great care in feeding; and also that between the age of from three to six months, — the time when they grow so rapidly in bone, — they are not during that time as desirable for table use. Taken all-in-all, we do not hesitate to say, that they are practically the best of all the breeds.

Of the balance of the Asiatic class, for a bird of real merit, we place the Black Cochin in the front rank. These fowls are short-jointed, and quick to mature, and will lay equally as well as the Light Brahmas; the hens being also good mothers. They do not hold their excellence as roasters beyond the age of ten months; the principal plea in favor of the Light

Brahma as a preference being their roasting merit so late in the Spring, when good poultry is very difficult to obtain.

The Dark Brahma and Partridge Cochin, as far as practical fowls are considered, in our opinion, come next in merit. When exquisitely penciled, their plumage is exceedingly beautiful, but as they do not produce so large a number in a hundred, fit for exhibition, that is, do not breed so perfectly, and true to color, and are also less prolific, as layers, we must place them in the third rank; but to the fancier, whose pleasure is found in the most bright and beautifully colored plumage, the Partridge Cochin will take the lead, while the more modest tints, with equally fine penciling, seen in the plumage of the Dark Brahmas, find many admirers.

Of the poultry found in the middle group, viz.: Plymouth Rocks, Houdans, Black Javas, Crevecoeurs, La Flèche, etc., we would say, for the New England and Middle States, for practical purposes, the Java and Plymouth Rocks are of equal merit, while the South Middle States could produce the Houdan with profit; but to speak of each, we say, if forced to choose, we would give the Plymouth Rock the preference; its great excellence being rapid growth, and its adaptation to making good broilers; a demand so large during the summer months. The young chicks make fine broilers at the age of twelve weeks, and are very hardy; they mature early, laying at five months of age, hence are good fall producers of eggs. Demerits, not good roasters, as they become tough and hard in flesh soon after six months of age, and are no more than average producers of eggs in winter.

The Houdans are quick growers, and like the Plymouth Rocks must, as poultry, be marketed before seven months old; they are good layers of white eggs, but their heavily muffed and crested heads make them predisposed to lice, and in damp weather they are also liable to roup, requiring great care as to quarters free from dampness and drafts of air, which has made them undesirable for New England climate; but in a more southerly climate, we believe them better than the Plymouth Rock, where light-colored meat is tolerated, and a preference given to white eggs; for it is a fact that they will produce more eggs in a year than the 'Rocks,' or Java fowls, but the chicks, in a northern climate, cannot be called hardy or easily reared.

We class the Game fowl among the lesser medium-sized birds. They are the fancier's stock, and the Black-Red variety may be called both the aristocrat and pugilist of the poultry yard. It is true, that at four months of age their flesh is as fine, if not finer than any other, but as their eggs seldom reach a number in excess of one hundred and twenty-eight yearly, we can call them no more than an average, and by no means up to the best breeds for practical purposes. The chicks are hard to rear.

The Black Spanish may also be called of the lesser medium class in size. They are fair layers of large white eggs, and average about one hundred and twenty-five in number during the year; yet their eggs will, we think, weigh as much as one hundred and fifty eggs of the Leghorn variety, of the Spanish class. While we consider the race not a profitable one for practical purposes, yet its class with the Asiatic is a very prolific egg-producer.

Among the small varieties, we think the Leghorn the best, and possessing far more merit than the Hamburgs, yet the latter are much prized for their exquisite beauty of plumage, and though delicate to rear, they seem quite hardy when once mature. Their eggs are small and white, and a single hen has been known to lay one hundred and fifty-one eggs in six months; but as a rule, one hundred and sixty eggs would be considered the full average for a year.

The Leghorns are the most prolific layers of all the breeds; the best authoritative record yet known is that of fifty-one hens with an average of two hundred and seven eggs each, and a profit of $4.04 per head for the year, being the 'banner' statement yet on record. They are of small size, but make very good broilers, yet as roasters are positively worthless, being

too small and tough, when fully grown. With these remarks on the breeds, we come back to the summary, and say, that in New England and the Northern Middle States, Light Brahmas, Plymouth Rocks, and White Leghorns are the best for practical purposes, and since others will pay the breeder less, they become less valuable in comparison. For the Southern, Middle, and South Western States, we recommend Light Brahmas, Black Cochins, and Javas for large stock; Houdans for the middle size, and Leghorns.

As the temperature of the Southern States admits of birds being raised at all times of the year, we would recommend for that section of our country, Light Brahmas and Black Cochins for large stock; for those of smaller size, Houdans, Plymouth Rocks, and Leghorns. All other breeds must be looked upon from a fancier's standpoint, wherein taste must be the rule, as they are kept quite as much for pleasure as profit. But do not consider us as condemning outright all other birds, for we do not.

They will all pay a profit over and above their keeping; the Creator of all things has made them with qualities suited to their purpose, and just in proportion to the care we give our fowls, will we reap a harvest, no matter what the class; for instance: if the Light Brahmas lay ten eggs more iu a year than any other of the Asiatic class, then they become the best practically, and must be the bird chosen, as one Light Brahma hen pays the interest on three dollars more, as an investment, by her earnings. This however does not argue that all the Asiatics are not good.

Just so with the middle class,—locality and adaptability being first considered, next, the economic value. While Houdans may be better for France, and Black Javas for all purposes where only one breed is to be kept, and eggs as the sole product; we find that White Leghorns are the best for all sections of the country, since they will lay more and larger eggs than any of the non-sitting breeds, except the Black Spanish, which lay larger eggs, but being more delicate to rear, and less desirable as a table fowl, must go into the list of fancy stock;—hence we see that for the greater profit, in both poultry and eggs, the Light Brahmas, Plymouth Rocks, and Leghorns are the three best, while the best cross for all purposes is the mating of a White Leghorn cock to a Light Brahma hen."

To show the various preferences of bird fanciers and breeders on the subject of choice, we give a few other opinions from different sources. An extensive breeder gives his opinion as follows: "From all I could learn after a careful study of the subject, I decided that for both meat and eggs, no variety ranked higher than the Light Brahma, while for eggs the Brown Leghorns; were perhaps first. For experiment I wished varieties as diverse as possible, and secured them in the above breeds. The color and size of the eggs, and the appearance, habit, and temperament of the fowls are indeed very wide apart. With the Light Brahmas we have not been disappointed. They have proved even better layers in winter than our Brown Leghorns; their eggs are fine in quality, large, and of rich color. At the age of six months the cockerels weigh seven and eight pounds, and while they may not quite equal the Games, the Dorkings, or the Houdans for table use, I am sure no one will go away hungry or dissatisfied from a dinner graced by a Light Brahma.

From my own experience, as also from a thorough study of the opinions of others, I think there is no fowl that equals the Light Brahma for the farmer. Possibly the Plymouth Rock may rank nearly as high. The quiet temperament, too, is a recommendation of no mean rank in favor of these fowls. The chief objection, and the only one, so far as I know, unless we might desire a little more white meat, is the proclivity of this breed to sit. With suitable preparation to break this determination, it is no serious objection, especially if we kill all our hens the second winter, never keeping them until they are two years old. I have noticed that there is a great difference in individuals in this respect. So without doubt by careful selection in our breeding we could modify this trait to our satisfaction.

The Brown Leghorns I have found to be perfect non-sitters. They are admirable layers,

except in cold weather—perhaps my house is not warm enough for them—when I have found them much inferior to the Light Brahmas. The eggs are white, large, and fine. The Leghorns mature quickly, when they weigh three or four pounds, and are, I think, almost useless for table use. They are wild and intractable. A fence five feet high is Brahma proof. As much cannot be said of one three times as high if the word Brahma be replaced by Leghorn. I cannot recommend the Brown Leghorn, though I have a flock for sale. From my reading, and a slight experience, I think I might almost say as much of the Spanish, the Hamburgs, and the White Leghorns.

Though I am satisfied with the Light Brahmas I have a desire to test the Games, because of their incomparable excellence for table use, and the Plymouth Rocks, which are so highly recommended by those who have them. Yet I feel assured that this test, which I am to make in coming years, will only serve to make me more a friend of the Light Brahmas. The grace and symmetry of the mature Light Brahma is fully comparable to that of our best-bred Short-horns, while their color forms a beautiful contrast to the green of the summer landscape."

Another writer of experience speaks in equally complimentary terms of the Houdans, and after mentioning the popularity of the Light Brahmas, Plymouth Rocks, Leghorns, and Hamburgs, says, that for hardihood, laying qualities, and as poultry for the table, they (the Houdans) have no superiors, and expresses regret that more of our breeders do not turn their attention to them especially. The writer bred them for years side by side with Games and Dorkings, losing no chicken by disease, when he lost one out of four of the Dorkings, and one out of ten of the Games.

Another breeder of large experience expresses his preference thus: "How much easier to give the poultry the little attention required, than is the trouble of raising, and the care of cattle, which no thrifty farmer ever complains of! When we pass a neat-looking farm, the buildings in good repair, the cattle and sheep fat and contented, and the home of a nice flock of Plymouth Rocks, Brahmas, Leghorns, or some other varieties, is not there, something is wanting to make that farm complete; for where is the individual that was brought up on a farm where poultry was kept, that does not remember the happy hours feeding the chickens, and hunting eggs in the hay-loft in his boyhood? No farm is complete without a well-regulated poultry-yard of thorough-bred poultry. How surely they pay for every kernel of corn they eat! In consideration of the importance of poultry to us, the question presents itself, What breed should we keep?

In raising poultry for market, we recommend Light Brahmas, Dark Brahmas, Plymouth Rocks, Houdans, and White Cochins. These are quick to grow, take on fat at an early age, and are of excellent color when prepared for market. If eggs only are wanted, then some of the small varieties are recommended, White and Black Leghorns, Brown Leghorns, Games, and Hamburgs. We have about twenty White Leghorns, and know they are excellent hens to lay. Whatever breed you keep, they require proper care and food: the better care and keeping the larger the returns will be."

Mr. W. H. Todd, of Vermillion, Ohio, says: "We should classify the best breeds for fowls and eggs in their order as follows: Dark and Light Brahmas, Partridge, Buff, White, and Black Cochins; for size, eggs, and all purposes, with early maturity, Plymouth Rocks, Black Cochins, and Dorkings; the latter we don't recommend for this climate, as they are too liable to disease. For eggs, we should place non-sitters at the head of the list: should say Leghorns, Houdans, Hamburgs, and Spanish; of course where non-sitters are kept, it is necessary to keep a few Cochin or Brahma hens to perform maternal duties. For whatever purpose we keep fowls, it is best to so keep them that they will be a source of profit rather than a bill of expense.

When breeding for fancy, a handsome profit can be realized in the production of

eggs, and the cull stock for the table and market. Respecting the number of breeds, it is best to keep no more than we can keep well and have room for. We are not of those who believe no person capable of keeping but one breed and making a specialty of it. We do believe that one breed is all a great many people should keep, and more too, while there are others who can keep a large variety and breed them all well. We hold there is no limit to man's capacity to acquire knowledge and develope the mind in any given direction. That with ample room, where poultry breeding is made the sole business and study, no one breed will satisfy the desires or gratify the tastes of a mind large and active."

We add one more to the list of testimonials on this subject, the opinion of the editor of *The Poultry World*, which is as follows: "Some beginners, and many that are contemplating keeping a few prime fowls for pleasure and profit, unless previously informed by reading some good poultry paper or book, often ask, "What breed must I keep to obtain the most beautiful plumage, the most prolific layers, the greatest size and weight, and the sweetest and best flavored flesh?"

Poulterers must not expect to find all these merits in one variety. A breed that would combine all these beautiful, useful, and profitable qualities would certainly include ideal fowls. Nature wisely apportions and compensates, distributes and divides to each breed or variety certain or special merits, but at the same time she never violates her inexorable laws by allowing them to excel in an eminent degree in all things.

Some breeds excel in hardiness, adaptation to exposure and climatic changes, as for instance, the Langshan, Dominique, Cochin, and Plymouth Rock. Now, nature does not provide these with gorgeous plumage; they wear a sombre and plain every-day dress, and are well fitted for a cold climate. The Polish fowls are very ornamental, and good layers. These prominent qualities make them special favorites; but they are not hardy, nor is their flesh as toothsome as that of some other breeds.

The Dorking is superior to any of our domestic breeds for delicate and well-flavored flesh. This quality commends them to epicures and all lovers of sweet and nutritious meat. Yet in points of laying, hardiness, and external beauty they are not superior.

The Spanish fowls are all great layers; this is their *forte*. We see a sameness in their appearance; almost all are clad in solid colored plumage, and are deficient in gorgeous tints or exquisite pencilings, and their flesh is not as rich and juicy as that of the Dorking.

The Hamburgs are among the most beautiful of our varieties; they are superior layers, but their flesh, though good for home use, is unprofitable, on account of light weight, for market purposes.

The Asiatic varieties excel in size and weight; they are hardy, quiet, well acclimated, and the best of winter layers. But for grace, carriage, sprightliness, and attractive plumage, they are not equal to some smaller fowls.

The Games are noted for their varied and matchless plumage; some of the varieties are transcendently beautiful. The rich, glossy colors, the iridescent gold and purple, that harmonize with vivid and metallic green, are exquisitely handsome, and make a good offset to what some consider prominent defects.

Thus we see how difficult it is to attain perfection in all things. We are striving on our progressive march to combine most of these rare qualities, and we have accomplished much toward this end; still, we must keep in mind that "Excelsior" is our motto.

It will be seen by the perusal of the previous statements by noted breeders of poultry, and writers on that subject, that the number of valuable breeds is "legion," and while in minor points each individual fancier may have his own peculiar preference, and perhaps favorites, from having bred them most, and therefore the best acquainted with the breed, still they all agree sufficiently in the main, on the merits of standard breeds. The novice in poultry matters has therefore only to consider what qualities he desires most in his stock,—what breeds are best suited to his locality, climate, soil, general surroundings, extent of range for his fowls, etc., and select accordingly.

# GLOSSARY OF TECHNICAL TERMS.

THE following glossary of the various technical terms used by poultry fanciers, together with the illustration representing the points of poultry on a following page, may be of value to those not already familiar with them, in understanding the description of the different breeds of fowls:

*Beard.*—A bunch of feathers under the throat of some breeds of chickens, such as Houdans or Polish.

*Breed.*—Any variety of fowl presenting distinctive characteristics.

*Brood.*—The family of chicks belonging to a single mother.

*Broody.*—Desiring to sit or incubate.

*Carriage.*—The attitude or "style" of a bird.

*Carunculated.*—Covered with small fleshy protuberances, as on the head and neck of a turkey cock.

*Chick.*—A newly-hatched fowl.

*Chicken.*—This word applies, indefinitely, to any age under one year old.

*Clutch.*—This term is applied both to the batch of eggs sat upon by a fowl, and to the brood of chickens hatched therefrom.

*Cockerel.*—A young cock.

*Comb.*—The fleshy protuberance growing on the top of a fowl's head.

*Condition.*—The state of the fowl as regards health and beauty of plumage.

*Crest.*—A crown or tuft of feathers on the head, of the same significance as top-knot.

*Crop.*—The receptacle in which a fowl's food is stored before passing into the gizzard for digestion.

*Cushion.*—The mass of feathers over the rump of a hen, covering the tail,—chiefly developed in Cochins.

*Dubbing.*—Cutting off the comb, wattles, and ear-lobes, so as to leave head smooth and clean.

*Ear-lobes.*—The folds of bare skin hanging just below the ears,—by many called deaf-ears. They vary in color, being red, white, blue, and cream-colored.

*Face.*—The bare skin around the eye.

*Flights.*—The primary feathers of the wings used in flying, but tucked under the wings, out of sight, when at rest.

*Fluff.*—Soft, downy feathers about the thighs, chiefly developed in Asiatics.

*Furnished.*—When a cockerel has obtained his full tail, comb, hackles, etc., he is said to be furnished.

*Gills.*—This term is often applied to the wattles.

*Hackles.*—The peculiar, narrow, long feathers on the neck of fowls.

*Henny or hen-feathered.*—Resembling a hen from the absence of hackles and sickle-feathers, and in plumage generally.

*Hock.*—The joint between the thigh and shank.

*Keel.*—A word sometimes used to denote the breast-bone.

*Leg.*—In a living fowl, this is the scaly part, usually denominated the shank. In a dressed bird the term refers to the joint above.

*Leg-feathers.*—Feathers growing from the outer sides of the shanks, as in Cochins.

*Mossy.*—Confused or indistinct marking in the plumage.

*Pea-comb.*—A triple comb, resembling three small combs in one, the middle being the highest; such, for instance, as may be seen in the illustration on page 476.

*Penciling.*—Small markings or stripes over a feather. These may run straight across, as in Hamburgs, or in crescent-like form, as in Partridge Cochins.

*Poult.*—A young turkey.

*Primaries.*—The flight-feathers of the wings, hidden when the wing is closed, being tucked under the visible wing, composed of the "secondary" feathers. Usually the primaries contain the deepest color belonging to the fowl, except the tail, and great importance is attached to their color by breeders.

*Pullet.*—A young hen. The term is not properly applicable after a bird is a year old.

*Rooster.*—An American term for a cock chicken.

*Saddle.*—The posterior part of the back, reaching to the tail in a cock and answering to the cushion

in a hen,—cushion, however, being restricted to a very considerable development, as in Cochins, while "saddle" may be applied to any breed.

*Secondaries.*—The quill feathers of the wings which are visible when the wings are folded.

*Self-color.*—A uniform tint over the feather.

*Shaft.*—The stem or quill part of a feather.

*Shank.*—The lower and *scaly* joint of the leg.

*Sickles.*—The long, curved feathers of a cock's tail,—properly applied only to the top pair, but sometimes used for one or two pairs besides.

*Spangling.*—The marking produced by a large spot or splash on each feather, differing with that of the ground-color.

*Spur.*—The sharp defensive weapon on the heel of a cock.

*Squirrel-tailed.*—The tail projecting in front of a perpendicular line over the back.

*Stag.*—A term used for a young cock, chiefly used by Game Fanciers.

*Station.*—An ideal standard for games embodied in *style* and *symmetry.*

*Strain.*—A race of fowls that has been carefully bred by one breeder, or his successors, for a number of years, and has acquired an individual character of its own.

*Symmetry.*—Perfection of proportion; often confounded with carriage, but quite distinct, as a bird may be nearly perfect in his proportions and yet "carry" himself awkwardly.

*Tail-coverts.*—The soft, glossy, curved feathers at the sides of the lower part of the tail, usually of the same color as the tail itself.

*Tail-feathers.*—The straight and stiff feathers of the tail only; the top pair are sometimes slightly curved, but they are generally, nearly, if not quite, straight, and are contained inside the sickles and tail-coverts.

*Thighs.*—The joints above the shanks,—the same as the drum-sticks in dressed fowls.

*Top-knot.*—Same as crest.

*Trio.*—A cock or cockerel and two hens or pullets.

*Under-color.*—The color of the plumage seen when the surface has been lifted. It is manifested chiefly in the down seen about the roots of the feathers.

*Vulture hock.*—Stiff, projecting feathers at the hock-joint. The feathers must be both stiff and projecting to be thus truly called and condemned.

*Wattles.*—The red, depending structures at each side of the base of the beak, chiefly developed in the male sex.

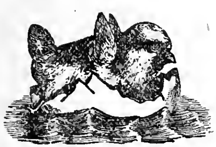
*Web.*—The web of a feather is the flat or plume portion; the web of the feet, the flat skin between the toes; of the wings, the triangular skin seen when the wings are extended.

*Wing-bars.*—Any line of dark color across the middle of the wings, caused by the color or marking of the feathers known as the lower wing-coverts.

*Wing-bows.*—The upper or shoulder part of the wings.

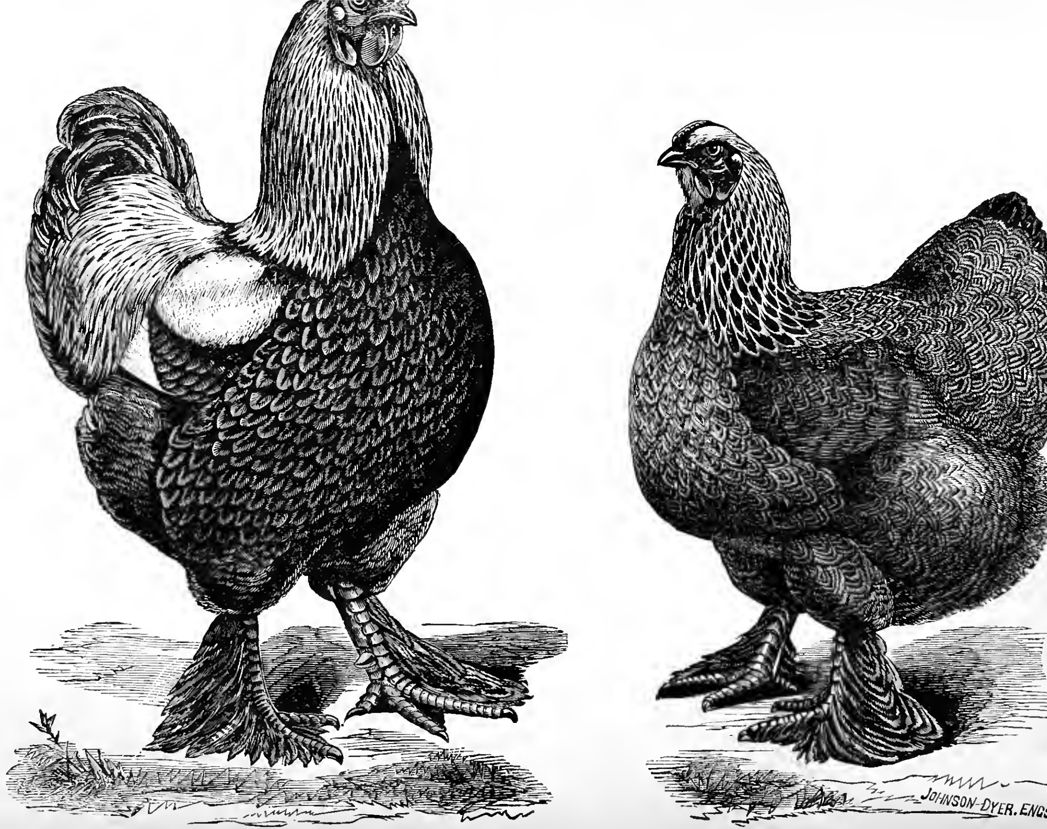
*Wing-points or Wing-butts.*—The ends of the primaries.

*Wing-coverts.*—The broad feathers covering the roots of the secondary quills.




## TECHNICAL TERMS.

1. Comb.
2. Face.
3. Wattles.
4. Deaf-ear or Ear-lobes.
5. Hackle.
6. Breast.
7. Back.
8. Saddle.
9. Saddle-hackles.
10. Sickles.
11. Tail-coverts.
12. True Tail-feathers.
13. Wing-bow.
14. Wing-coverts, forming the "bar"
15. Secondaries, lower ends forming the wing or lower butts.
16. Primaries, or Flights, not seen when wing is clipped up.
17. Point of Breast-bone.
18. Thighs.
19. Hocks.
20. Legs or Shanks.
21. Spur.
22. Toes or Claws.




DARK BRAHMAS.

Bred by Geo. P. Burnham, Melrose, Mass.

1288

## BRAHMAS.

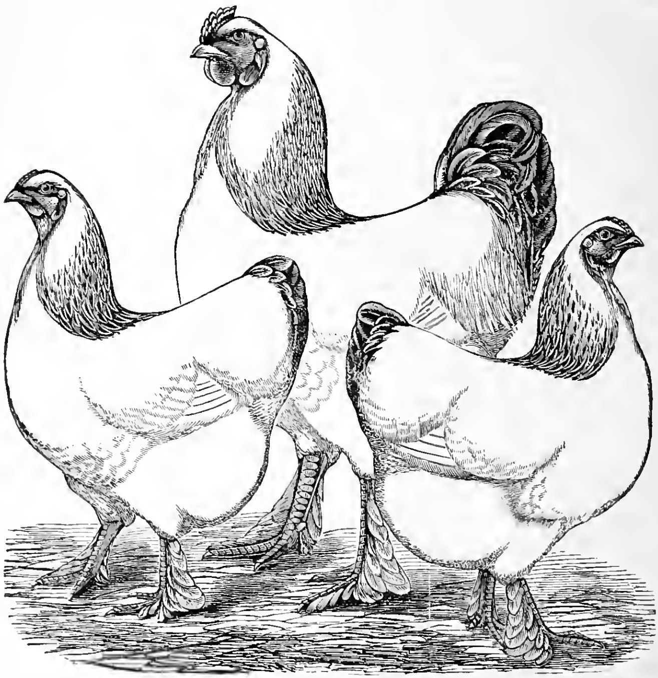
BRAHMA fowls, sometimes formerly called Brahma Pootras, have within a few years past become very popular, and are now regarded as one of the most desirable of the many favorite breeds; in fact, we know of no breed that is better adapted to the general poultry keeper's use, or that is regarded with more favor, their gentle disposition, quiet habits, laying qualities, as well as the fine quality of meat which they furnish for the table, placing them in the first ranks of the valuable poultry breeds. There has been quite an extended controversy among breeders respecting the origin of the Brahma, some holding to the opinion that this breed originated in a cross with the Cochin, others that it is entitled to rank as a distinct variety from Northern India. The argument in favor of the former, being the large size of the fowl, feathered legs, color of eggs, and formation of skull, while the adherents to the latter opinion have the strong argument in the unique and exceedingly peculiar comb, so entirely different from that of other breeds, the color, prominent breast-bone, different disposition and habits generally, together with the authority of the most eminent breeders in their favor. We quote the following description of the Brahma from Wright's Practical Poultry Keeper, a well-known authority on both continents:—

"Their most marked peculiarity is the comb, which is totally different from that of any other variety. It resembles *three* combs pressed into one. In a first-class cock, the effect is such as would be produced were a little comb, about a quarter of an inch in height, laid close to each side of his own proper comb, twice as high, the center one being thus higher than the others. Each division of the comb ought to be *straight* and even, irregular or twisted combs being serious faults in a show-pen. In the hens the comb is very small, but the triple character should be equally evident, and the formation is quite plain, even when the chicks first break the shell.

"There are two varieties of Brahmas exhibited, known as "Light," and "Dark" or "Penciled" Brahmas; and on no account should they be crossed, the result being, according to Mr. Teebay, who was formerly the most successful and extensive breeder of Brahmas in England, always unsatisfactory. The cross may be known, if the birds profess to be "dark," by the lighter, gayer appearance of the cock's breast, perhaps accompanied with large white splashes, and sandy colored or brownish patches about the pullets; this, however, must not be confounded with the brownish tinge which nearly all dark Brahma hens acquire with age. Should the fowls be offered as light Brahmas, the pullets will have buff, yellowish, or sandy backs and wings, and the cocks most likely yellowish hackles."

The Brahma, like all the Asiatic breeds, is of large size, yet unlike the Shanghai and Chittagong, the meat is of fine texture and delicate flavor, though not quite equal to the Dorkings in this respect. It seems to have taken the place of those old-fashioned breeds, once so popular, possessing all their good qualities, and rejecting the objectionable ones, except it may be an inclination to sit oftener than some varieties, but even this tendency differs greatly with different individuals. The writer had one fine Brahma hen in a flock of ten the past year, that commenced laying when a pullet of six months, and continued to do so with slight exceptions through the winter, spring, and summer, never inclining to sit even once during the year; this is an exceptional case, however. As to size of this variety, the cocks have been known to attain the weight of eighteen pounds, and hens thirteen pounds, and we occasionally hear of their turning the scales at even higher figures than these, but such instances of weight are very rare; even sixteen pounds is regarded as an unusual weight for a cock, and nine to eleven pounds for a hen is a good average weight. Cocks not weighing nine pounds, and hens not weighing seven and a half pounds are disqualified from prize exhibitions, according to the American poultry standard. Though of large size, Brahmas are not ungainly or awkward, like some of the other large breeds, but on the contrary, very graceful in form and movement.

**Light Brahmas.** The Light Brahma is generally larger, on the average, than the Dark of this breed. The color of the plumage is mostly white, but shows, when parted, a tinge of bluish gray toward the skin. The neck hackles are distinctly striped with black down the center of each feather, terminating to a point at the extremity, though in the cock the plumage of the neck is lighter than that of the hen, the upper portion being white, and the lower two-thirds marked as above described, the hackle reaching well over the shoulder in both cases. The neck is medium in length and well arched, though that of the cock longer in proportion than that of the hen. The back of each should be white in color, broad, and flat between the shoulders. The wings are small, and appear white when folded; but the primary feathers, being closely folded under the secondaries, are black, generally, though sometimes



LIGHT BRAHMAS.
Bred by George P. Burnham, Melrose, Mass.

edged a little with white. The secondary feathers of the wings are white on the outer web, and black on the inner web, being one-half black, and one-half white. The body is deep, and round at the sides, the breast full and broad. The tail is black in both sexes, and rather short, though spreading. The tail of the cock is full, carried rather upright, and well filled underneath with curling feathers. The sickle feathers are rather short; coverts show beautiful green reflections, and quite glossy. This fowl has a broad appearance behind, owing to the abundance of fine downy feathers, denominated "fluff," and which is developed so profusely in the Asiatic breeds. The legs of the pure breed are of medium length, with a reddish-yellow tinge on the inside, and well

covered with white feathers, or white mottled with black, the feathers covering the outer toes to the extremity. The head is broad, projecting over the eyes, with white plumage; the eyes large and bright; comb quite low, and is what is called "the pea comb," resembling three small combs pressed into one, the middle one being a little the highest; the peculiarity of this comb is discernible even when the little chicks first break the shell. The color of the comb is bright red; the ear-lobes and wattles are also of the same color. The beak is short and stout, and generally yellow, with a dark stripe down the upper mandible, giving it in some cases the hue of dark horn.

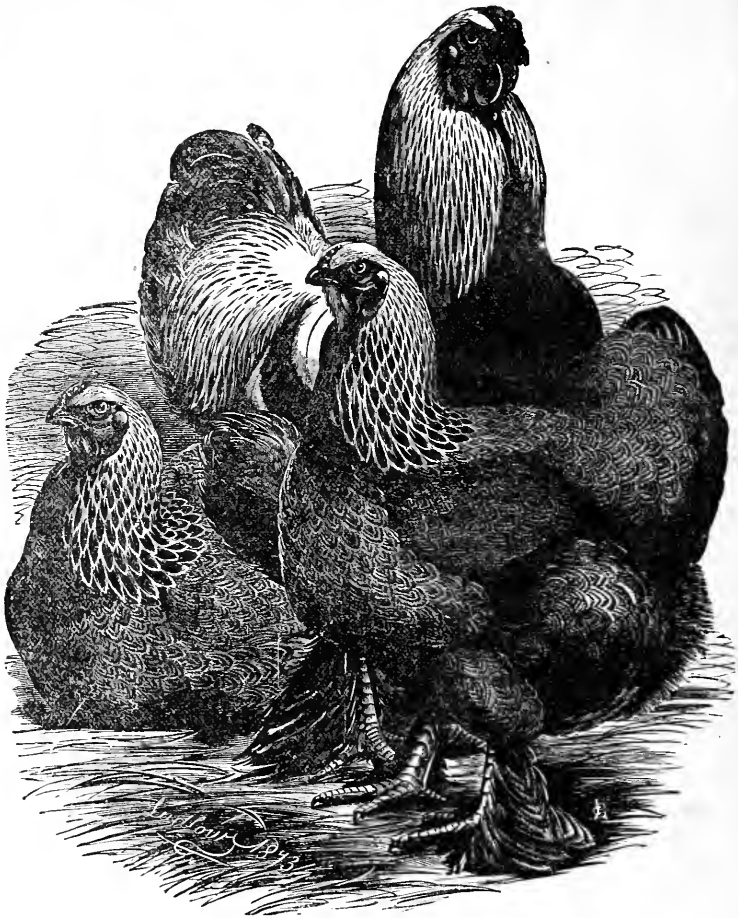
This variety seems to be more generally popular than the Dark, though they are equally valuable in most of the good requisites, and many prefer the latter as a matter of taste as to color of plumage. For our own part, we prefer the Light variety, as being more attractive in color they make such a striking contrast with the bright green of a lawn, and always have such a neat, attractive appearance. Most poultrymen consider them the better layers, the year through, than the Dark, though the latter are considered remarkably good layers, generally, and take rank among the best in this respect. Those who have had an extended experience in breeding this variety have given certain facts, the result of their experiments and observation, which may be of great benefit to those just commencing the undertaking. Chickens of this breed, when hatched very early in confinement, or with limited range, will often show very undesirable plumage during the first three months; but if they are allowed an extended range, where they can obtain plenty of fresh grass, they will improve wonderfully in plumage, even after five or six months old. Insect food and fresh grass are indispensable to the perfect development of the adult plumage. Therefore, do not pronounce a Light Brahma chick as worthless, as to color, because he has not a pure white back, or has a neck too white or too black, according to the proper standard of merit; with proper food and range they will generally come out "all right" in these respects, with the adult feathering, which might very properly be called their "new winter clothes." The dark beak in chicks of this age is indicative of a dark striped hackle in adult feathers, while the light or slightly colored beak indicates a light stripe in hackle feathers in full development. Vulture hocks, which are stiff projecting feathers at the hock-joint (or the joint between the thigh and shank), are considered a very great defect, and such birds should not be used for breeding purposes, but be carefully excluded from the pen. Mr. G. P. Burnham, who has been a breeder of Brahmas for about thirty years, says of them :—

"The Brahmas are among the largest average fowls now known in the world. They are excellent layers of large-sized eggs, and when well-fed and properly cared for, come early to maturity. The meat is fine-grained, and six to eight-months-old cockerels make superior fall roasters for table consumption. They are a quiet, domestic race, the chickens are very hardy, and after shedding their first feathers and putting forth their winter plumage, they are deemed among the prettiest birds we have in our poultry yards. They are, however, generous feeders, and will eat a third more than ordinary fowls, when kept in close runs. They are nevertheless good foragers — when allowed unlimited range — and so may be kept in good condition on much less provender during the summer and fall months, when permitted to run at large."

**Dark Brahmas.** — The Dark or Penciled Brahma is similar to the Light in comb, form, symmetry, etc., but quite different in color. The head of the perfect Brahma cock is always quite broad, projecting over the eyes, and surmounted by a good pea comb, which resembles three small combs running parallel the length of the head, the middle one slightly the highest, but all evenly serrated and straight, the whole low and set firmly on the head. The beak is strong, well curved, and the color of dark horn. The eyes, like those of the Light variety, are large and bright. The color of the head plumage is silvery white. The wattles are full, red, and well rounded; the ear lobes are also brilliant red, and about equal in length with the wattles. The neck is rather short, but well curved, with very full hackle,

which is silvery white striped with black, and flows well over the back and sides of the breast, the black stripe in the middle of each feather terminating in a point at the extremity.

The back is rather short, broad, and flat between the shoulders, somewhat rising toward the tail, which is rather small compared with the size of the bird, and carried rather upright.



DARK BRAHMAS.
Bred by Charles Gammerdinger, Columbus, Ohio.

The color of the back is silvery white, with dark pencilings corresponding with the outlines of the feathers; that of the tail is black; the larger coverts, a lustrous greenish black; the smaller or lesser coverts of the same hue, or greenish black edged with white. The saddle feathers are white striped with black, as in the neck, and the larger they are, the more beautiful the bird.

The breast of the perfectly marked cock will be either black, or black with each feather slightly and evenly mottled with white, but on no account should there be *splashes* of white, or *uneven* markings. It should be well carried forward, full, broad, and deep. The body, like the light variety, is broad and deep, the under part of which is black in plumage. The wings are small and well folded up under the saddle feathers and thigh fluff. A good sharply defined black bar across the wing is considered by good judges of this variety, very important.

The primary feathers are black, or black with a narrow border of white on the outer web; the secondary feathers are white on the outer web, and black on the inner, with a dark spot at the end of each feather. The fluff on the thighs and hinder part is very abundant and soft, and should be black or very dark grey.

The thighs are large and well covered with nice soft feathers, either black or black slightly mottled with white, which gives them the color of dark grey; the legs yellow and well feathered on the outside to the ends of the outer toes. The feathers of the legs are black, or black and white.

The color of the hen, except head, neck, and tail, is the same all over the body, each feather having a grayish-white ground with very dark pencilings corresponding to the outlines of the feather. "The penciling on the throat and breast," says an extensive writer on this subject, "is very important, and is one of the first points looked at in a prize hen." The legs of the hen are rather short and thick, and profusely feathered on the outside,—the feathers being the same color as those of the body. They are docile and gentle in disposition, quiet in habits, and do not suffer as much as other varieties do when they are confined.

The plumage being so distinctly and uniformly marked with black or dark pencilings, is very beautiful, and is thought by many to be more attractive than that of the Light Brahma, while the color being darker, would not attract the attention of their natural enemies,—the hawks, rats, cats, etc.; besides the plumage is not so easily soiled as the light variety, which in the confined pens of cities and villages, often become so dingy and begrimed with soot or dust, as to detract much from their original beauty.

A choice between the two varieties is mostly based upon taste as to color, since their intrinsic merits and economic value are about equal. They are a little more difficult to breed true to color than the light variety, though this with many would not be deemed a serious objection; they also do not average quite so large in size as the latter. We find with breeders generally who have bred both varieties, that the point of preference lies with that variety in which they have had the larger experience, and therefore the better acquaintance (aside from the question of color), since the Brahma breed has so many excellences, and so few defects that the better it is known, the more it is valued. Our own preference would be the light variety.

**Merits and Defects of Brahmas.**—As has been previously stated, Brahmas are of a gentle disposition, quiet in their habits, and thus easily kept within a limited enclosure, if necessary, which makes them a very desirable breed for farmers who do not wish their poultry to have a free range of their farm, also for those living in a village or city, where a limited space is absolutely necessary, since a fence three feet high will keep them enclosed, where one five times as high would be necessary to confine some breeds; besides they are almost harmless as scratchers compared with the Leghorn and some other breeds. They also make very good mothers, though care should be taken in hatching that the hen does not step on the young chickens and injure or kill them in this way, as her great size and weight would render her liable to such accidents, if she were disturbed.

The writer has at the present time pure-blooded Brahmas, and a cross between this breed and the white Leghorn, and while the former fully merit the good things we have said respecting them, the latter seem to inherit the objectionable traits of the Leghorn, viz.:

rambling, flying, and scratching, and, being more pestless in disposition, do not make as good, careful mothers as the former.

The Brahma pullets frequently lay when six months old, and usually lay from thirty to forty eggs before sitting. We have known instances where the pullets began laying in the fall and did not stop until the time of moulting, though this is not usually the case; individuals differ in some respects, but as a breed, they are among the best layers known; as winter layers they have no superiors. One writer says (writing at the last of November),—that he has a hen which has laid forty-five eggs during the last forty-eight days, while others of his Brahma flock are but little inferior to this.

Brahmas are very hardy and grow uncommonly fast: they are therefore desirable for table use. They have an abundance of breast meat, and the meat generally is of fine texture and flavor, though the Dorking is considered, by common consent, to be a little superior to all others in this respect, yet the Brahma ranks very high. On the whole, we know of no fowl that we could recommend with more certainty of success and satisfaction than the Brahma.

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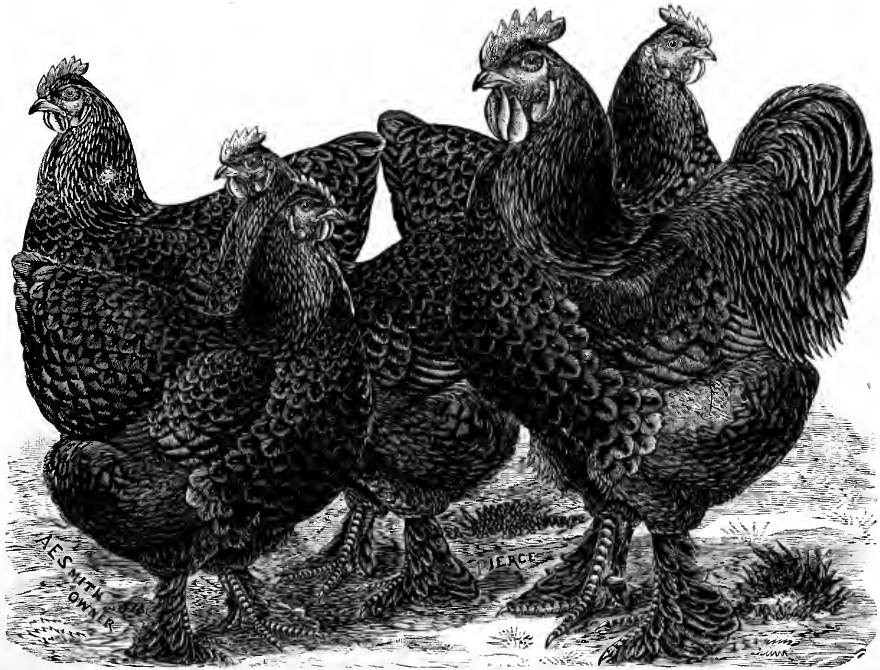
## COCHINS.

NO breed of poultry has ever attracted so much attention, or such high prices for so long a time as the Cochins, on their introduction to this country. They were introduced from China about the year 1847 or 48, and created a great sensation at the time, which has been humorously termed the *"poultry mania,"* or *"hen fever."* So great was the desire to possess them, that fabulous prices were paid. In England, a hundred guineas was often paid for a single cock, and equally high prices in this country. A reaction must of necessity follow, as a natural result, and the breed is not now as fully appreciated as it deserves, for it possesses really great merit. It is in the main, now superseded by those of greater merit, the Brahmas. The mania attending its introduction, however, absurd as it was, resulted in great benefit by awakening a general interest in the whole poultry subject, which has never since died out. They come next to the Brahmas in size.

The cock will weigh ten or twelve pounds, and sometimes will reach even fourteen when three or four years of age; the hen from eight to ten pounds. The principal varieties of this breed are Buff, Black, White, Partridge, Pea-Combed Partridge, and Silky Cochin or Emu Fowl. They are of gentle disposition, more hardy than any other breed, except Brahmas, grow fast, and are prolific layers, especially in winter, bearing confinement well. They cannot fly, consequently can easily be kept within a limited enclosure. The chickens feather rather slowly.

**Buff Cochins.**—The Buff Cochin is one of the most popular varieties of this breed. Its color, as the name indicates, is a clear, uniform buff, sometimes light in shade, and often deeper, the deep buff being considered the most desirable in color. Black penciling in the hackle is considered very objectionable, and a disqualification at a poultry exhibition, but we often find birds with a little marking of darker shade well defined about the neck, where it is not considered decidedly a grave fault, though the greater the uniformity of shade, the better. The hackles of the cock, back, wing coverts, and saddle feathers, are generally a rich gold color. The hackle flows well over the back and shoulders. The tail, which is nearly concealed by the cushion in the hen, is quite small, and usually buff in color; that of the cock is also small, short, and full, and not carried very erect; the most desirable color of the tail, is a rich, dark chestnut, or bronze-tinted chestnut mixed with black, though the less black




BLACK COCHINS.

Bred by A. E. Smith, Cherry Falls, Mass.

there is in the tail of either sex, the better. The wings are very small, which renders flying impossible, while the breast is deep, broad, and full, and the body broad and deep; the back broad and rising from the middle towards the tail. The fluff is very abundant, the quality of which is considered a good test of the breeding; if fine and downy, the bird is considered well bred; if coarse and rank, the reverse. The thighs are very large and strong, and abundantly supplied with fluff, giving the birds a very broad appearance.

The legs are yellow, and heavily covered with buff feathers to the ends of the outer and middle toes; they are short and set wide apart; the neck short and well curved; this, with the broadness of the back, and the wings and tail being small, has a tendency to give the bird rather a clumsy appearance, though the carriage of the cock is upright and stately in the extreme. The hen has a very matronly appearance. The head of both sexes is rather small comparatively for the size of the body; the comb red, single, straight, and evenly serrated; wattles and ear lobes red, the latter quite large and pendant, though of fine, firm texture; the beak is yellow. The eyes are bright and sprightly, often approaching the color of the plumage. They are withal, a very handsome, domestic, and docile bird, and quite popular with many of our extensive breeders, as the many fine specimens at our poultry exhibitions attest.

**Black Cochins.**—This variety are not bred as extensively as the Buff, Partridge, and White Cochins, owing to the fact of its being more difficult to retain the color free from stain, as white or gray under feathers are quite liable to make their appearance. They are quite liable to appear also in old birds that have previously been a jet black color. A golden or reddish tinge about the neck is also quite objectionable. The color should be a rich, glossy black. The eyes are bright, and dark red; the beak yellow, shaded with black, giving it the color of horn. The legs are also yellow, shaded with black, often nearly black, and feathered down the outside with jet black feathers, the outer and middle toes being also well feathered. The tail feathers of the cock have a beautiful metallic lustre. In all respects, except color of plumage, eyes, legs, and beak, they are similar to the Buff Cochins previously described.

**White Cochins.**—This variety is very neat in appearance when bred true to color, which should be a pure white, avoiding as far as possible the yellow or gray tinge in plumage. They are not, however, bred as extensively as the Buff and Partridge Cochins, as their plumage is more liable to become dingy and soiled with dust and soot when confined to a limited enclosure, which detracts much from their beauty. If, however, they have a large, clean run, with plenty of range, this objection is in a great measure avoided, for, as we have previously stated, they are a very neat, attractive bird.

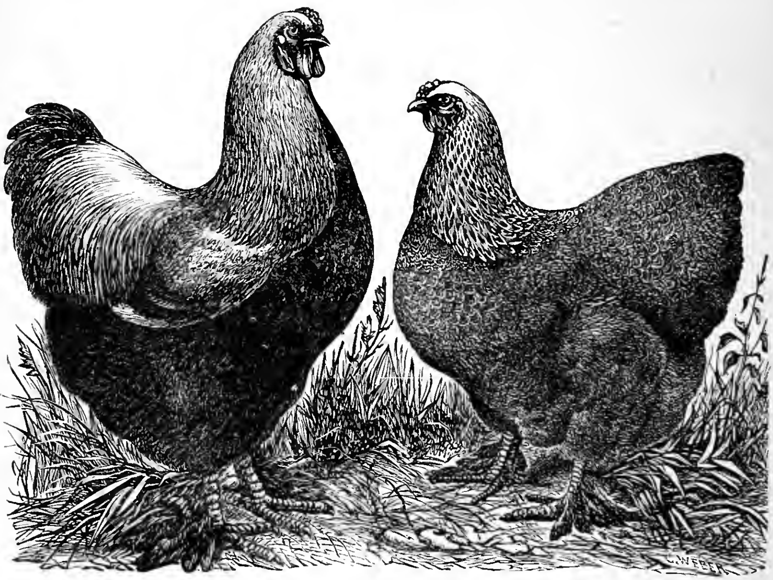
The beak of this fowl is short, stout, and well curved, and of a rich yellow color. The eyes, pearl color or bright red. Aside from the color of the eyes and plumage, our description of Buff Cochins will answer the description of this variety, thus obviating the necessity of frequent repetitions.

**Partridge Cochins.**—These with the Buff variety, are the most popular of the Cochin breed, and have been, within a few years, gradually gaining in popular favor, as they present a very attractive appearance with their bright plumage and substantial form, while the aristocratic and stately carriage of the cock, combined with the motherly and contented bearing of the hen, their docile disposition and quiet habits, cannot fail to attract the attention and admiration of those who do not consider themselves bird-fanciers, or critics in this respect.

We can give no better description in a condensed form, than that given by Mr. Wright, whose works on poultry are so well known to the general public: "The cock should be a rich orange-red color about the head and hackle, the latter being striped with black; a black stripe

running down the middle of each feather. The saddle feathers are similar to the hackle. The back, shoulder-coverts, and wing-bows, are of a richer and darker shade. The breast, thighs, under part of the body and tail should be a rich black. The hen has a hackle of rich gold color striped down the middle with black; the remainder of the plumage being light brown, penciled with a darker shade of brown."

The plumage is very rich and elegant, the pencilings of brown heightening the beauty to those who have an eye suited to the harmony in color. The tail feathers of both cock and hen are mainly black with a greenish lustre; sometimes the lesser coverts will be edged a little with red. The legs and skin, like all the Cochin varieties, are yellow. The size, form, and general appearance are similar to those of the Buff Cochin, for description of which the reader will there find one sufficiently definite for all practical purposes.



PEA-COMBED PARTRIDGE COCHINS.

**Pea-Combed Partridge Cochins.**—This variety is quite similar to the Partridge Cochins previously described, with the exception of the comb, which in the one case is single with regular and well defined serrations, while with this variety it is very peculiar, resembling three small combs pressed into one at the base, the middle one being a little the highest, the whole being rather low on the head and slanting erect; that of the hen being quite small. This variety is not quite as much inclined to sit as some of the others, the Buffs, for instance. There is an advantage also in the double comb over the single, in our northern climate, since it is less liable to freeze.

Mr. G. P. Burnham, the illustration of whose fowls of this variety we insert, says of this breed, "They are a very prolific race, the hens proving extraordinary winter layers."

**Silky Cochins or Emu Fowls.**—Cochins possessing a peculiarly silky plumage, similar to the Silkies, which are hereafter described in this department, are called Silky

Cochins or "Emu" fowls. The entire plumage is of a flossy character, and seems to be an occasional sport from the common Cochin fowl. In every other respect they are like the ordinary Cochin breed. These accidents or freaks of nature are said to be more frequent in the Buff variety than any other. They are generally smaller than the ordinary Cochin, though the fluffy character of their plumage makes them seem equal to the others in size.

They are not as hardy as the others, and do not possess sufficient merit to make them profitable to perpetuate, as a distinct breed.

**Merits and Defects of Cochins.**—Cochins are good layers, especially in winter, when eggs are most scarce. They make excellent, careful mothers, and in this respect are unsurpassed, though perhaps the Brahmas are fully their equals. When keeping a non-sitting breed, it is always well to keep a few Cochin or Brahma hens to perform maternal duties, and where successive sittings are desired, we know of none better than this breed. The chickens feather slowly, but are very hardy, more so than any other breed, except the Brahmas; they grow rapidly, and are early ready for market or table use. They fatten easily and are not as particular as to choice of food as some breeds. In consequence of their fattening propensities, therefore, care should be taken not to feed them too much on corn exclusive of other kinds of food when laying, as it will have a tendency to impede and often stop this function entirely for a time, on account of the superabundance of fat deposits, and will even sometimes cause death.

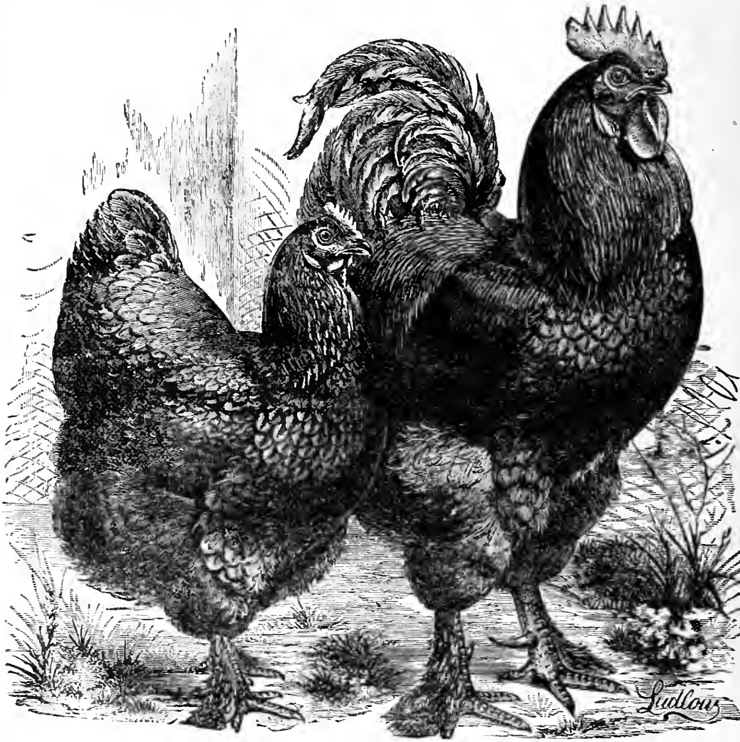
They are extremely docile in disposition, quiet, and we might add, lazy in their habits; are naturally gentle and tame, consequently easily domesticated, and very peaceable; seldom quarreling. They are very large and heavy, and as their wings are proportionately small, they cannot fly, therefore a fence two feet high will effectually keep them within bounds, while their quiet habits have a tendency to prevent their scratching, and they consequently do little damage in this respect, wherever kept, compared with some other breeds. When young, the flesh is quite good, and as they grow rapidly, may be killed when three months old. They bear confinement well, and will thrive where some breeds would droop and die for want of exercise and extended range.

As to their defects: though they make most desirable mothers in all respects, the serious objection is their frequent and persistent inclination to sit; this fever (for it is as much that as anything) generally comes on after every dozen or twenty eggs laid. It requires about three days absence from the nest to break up this propensity for the time. Although this is usually considered an objection, yet when a regular and constant succession of chickens is desired, it becomes a great convenience, as chickens can be hatched with great regularity.

Their flesh is not regarded as equal in quality to that of some other breeds, though as we have before stated, when quite young is quite good. The breast meat is not abundant, which affects its popularity in the market. Cochins are considered valuable for crossing with other breeds, such as the Dorkings or Crèvecoeurs.

## LANGSHANS.

THE Langshans are natives of Northern China. Although they were introduced into England in 1872, where they were generally regarded with favor, they have not been much known in this country until within the last four or five years; yet the limited acquaintance we have had with them, and from what our worthy brother across the water—"John Bull,"—says of them also, we have no doubt they will take high rank among our first-class fowls, and prove what they promise,—a valuable acquisition to our poultry breeds. They are large, like all the Asiatic breeds, and somewhat resemble the Black Cochin, though in many respects entirely different; the tail is longer and the comb larger than that of the Cochin; the eggs are also very different from the latter, being specked, or mottled, and they




LANGSHANS.

Owned by Maj. A. C. Croad, Durrington, Worthing, England.

are also a more active fowl than the Cochin. The comb is single and straight, bright red, and deeply and evenly serrated; the head small for the size of the bird, and full over the eye like the Brahma. The plumage is a beautiful greenish black, with metallic reflections. The color of the legs,—which are well feathered on the outside,—is a purplish black, or dark slate, while between the toes and scales it is of a decidedly pink tinge. They are full and deep in body; the breast being broad and carried well forward, as in the Dorking, while the general contour is round and deep like the Brahma. The average weight of cocks is from nine to

ten pounds; that of the hen about eight pounds. A gentleman who has been a successful importer of these birds writes of them as follows: "I first became acquainted with this breed in 1860, when I came across them in Chinese Tartary, and, being an enthusiastic ornithologist, I devoted considerable attention to these 'Turkey fowls,' as the Chinese called them, the natives always asserting in their ignorance that the Langshans were allied to the wild turkey. Subsequently I saw more of these Langshans in the vicinity of Hankow, 600 miles up the Yang-tsze-Kiang River, and it was from these that I brought specimens to England."

The name given them was from the locality in which they were found, which is the northern province of China called Langshan. Major A. C. Croad, of England, who has published a book pertaining to this breed, and is also an extensive importer of these fowls, says of them:—"To begin with the Langshan chick—on emerging from the shell the back is always black, its head, face, and breast a mixture of black, white, and different shades of canary. These shades are by no means distributed according to rule, but anyone seeing a brood of Langshans would at once pronounce them to be of one family. I have bred an immense number of these birds, and any variation from what I have stated I have always been able to trace to a cross. The young birds often retain white nest feathers until they approach maturity, and here and there a cockerel sports red or golden feathers, which are repeated with every moult. These (I suppose I must call them imperfect specimens) are often wondrously handsome, the colored feathers having all the sheen peculiar to the black. I have found that from a cock with these imperfect markings you are just as likely to breed black chickens. The face, wattles, and ear-lobes are a bright red color, neck long and full, back short and broad, rump high, tail very full and flowing with long sickles; the eyes and beak are dark; black-penciled legs. The hue of the leg I consider a most essential point, for I have never found it to vary. The leg feathering, on the contrary, varies considerably. My imported specimens (with two exceptions that were without) have been what I should consider well-feathered. The plumage is glossy black, very brilliant, lustrous and sheeny. One great argument in favor of their being a pure, distinct breed is, that as a rule they come so true to color and style. They are excellent layers through summer and winter alike, and as table fowls are not to be surpassed, for combined with great bulk is the thin skin, white flesh of fine texture and delicate flavor."

We are indebted to the courtesy of Mrs. R. W. Sargent, Kittery, Me., the importing agent of Maj. Croad in the United States, for the fine representation of this breed.

**Merits and Defects of Langshans.**—The Langshans, being natives of Northern China, are easily acclimated to our country, and extremely hardy, withstanding readily the severest weather. Being of large size, with white flesh and skin, they make an excellent table fowl, more especially on account of the delicacy of flavor which the flesh possesses. They lay large, rich eggs the year round, are good winter layers, while they are less inclined to be troublesome as incubators, since they lack that intense desire to sit that is characteristic of the Cochin and most Asiatic breeds. Their bearing is quite aristocratic and proud. Any tendency towards vulture hocks or russet tinge in plumage is very objectionable, and such birds should be discarded from the breeding pens.

## LEGHORNS.

LEGHORNS are natives of Italy, and consequently arrive at the greatest perfection in a southern climate, but as they have become well acclimated to our country, they thrive well in all parts, and suffer no detriment from our cold winters, except occasional disfigurement of combs and wattles, which being large, and the comb also single, will sometimes become frost bitten in our coldest weather north, unless well protected by a warm, comfortable house. They are very hardy, and less liable to the diseases common to poultry than almost any other variety.

They are very desirable as egg producers, and this is their crowning merit; they are non-sitters, consequently when keeping this variety, it will be necessary to keep a few hens of some other breed, Brahmas or Cochins, for instance, to perform the maternal duties of the hen establishment. They are persistent layers nearly all the year round, if given warm winter quarters (which every fowl ought to have), and well cared for otherwise. They require a free and extended range, are great foragers, and will thrive well with ordinary care if given unlimited range, and plenty of fresh, cool water.

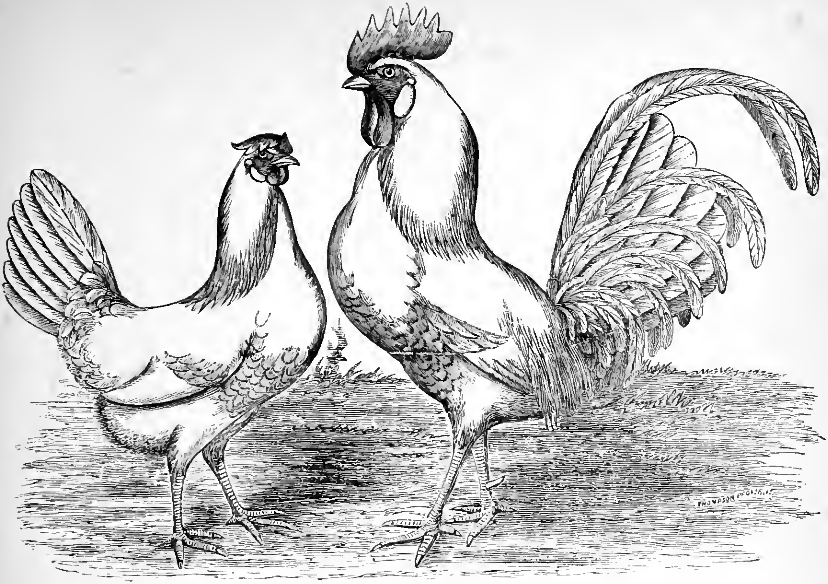
They mature early; the cockerels often crow at six weeks of age, and pullets have been known to lay at four and a half months. The eggs are pure white, and large, compared with the size of the fowl. The average weight of the cock is from 4½ to 6 pounds, that of hens from 3½ to 4 pounds. This breed is quite popular at present, both in this country and Europe, and where eggs are mainly the desideratum, and there is plenty of range, we know of no more profitable fowl to keep. Though their flesh is of good quality, their small size would not recommend them as a table fowl, their chief excellence, as we have before stated, being that of egg production. A new variety of this breed has been recently introduced, having rose combs, which will have a tendency to do away with their chief objection in extreme cold climates, viz., large combs.

The varieties of this popular breed of fowls are Black, Brown, Dominique, White, and Rose-Combed White, though the most common are the Brown and White varieties.

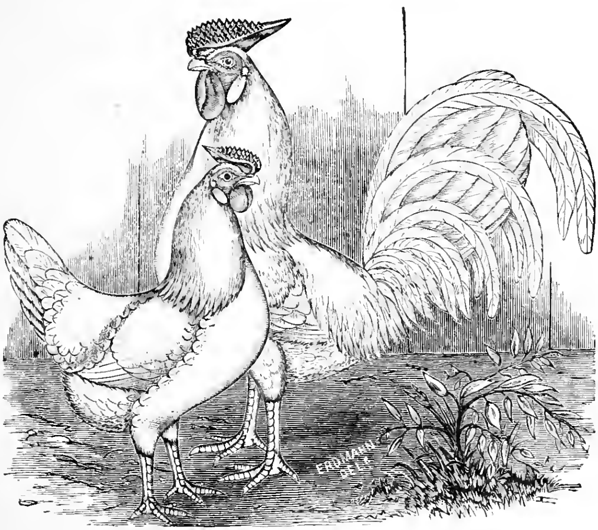
**Brown Leghorns.**—This is one of the most popular varieties of the Leghorn breed, their beautiful plumage making them very attractive, aside from their great merits in a more practical point of view. The color of the head is a dark, reddish brown, approaching a bay, which shades into a lighter hue on the neck of the cock, and becomes a rich golden bay, striped with black, on the hackles. The plumage of the back is very dark red or nearly black, each feather being striped with a golden bay, which gives it a very rich appearance. The breast shades to a black on the under part, while the wings are a blending of dark red and golden bay with coverts of a greenish black, which are quite lustrous, forming a definite bar across the wings; the tail is carried rather upright, is large for the size of the fowl, and quite full, being of a rich black with lustrous green reflections, which, with his proud, aristocratic bearing, makes him quite an attractive object.

The neck of the hen is a yellowish brown striped with black, each feather being striped with black down the middle. The general color of her body is dark brown, finely penciled with light brown; her tail black, with occasional slight pencilings of brown. The comb is bright red, single, deeply and evenly serrated, and quite large for the size of the fowl; that of the cock usually stands upright, being broader at the base, while that of the hen usually falls over a little to one side at the top, as represented in the cut of these fowls.

The ear-lobes are white, or nearly so; the wattles, like the comb, are bright red, quite long and thin, and swing with every motion of the head. The legs are bright yellow, while the feet are the same color, with a very delicately marked dark stripe down each toe. The



WHITE LEGHORNS.
Bred by Samuel Cushman, Pawtucket, R. I.



ROSE-COMBED WHITE LEGHORNS.
Bred by N. D. Forbes, New Haven, Conn.

eyes are bright and full, and the manner sprightly. Like all the varieties of the Leghorn breed, they are more restless and nervous than many other kinds, and will forage extensively when given the opportunity, which makes them very desirable for those farmers who have a wide range and do not object to poultry having free access to it.

They are very hardy and easily reared; being of small size, they require less food than some of the larger varieties, while they also mature earlier. They are bountiful layers, and are unsurpassed in this respect; the egg is pure white. Their color is such that it draws more heat from the sun's rays in winter than the white fowl, which some of the poultry fanciers, having a partiality to this variety of the breed, give as an argument in favor of brown over the white plumaged fowls, but for our own part we see but little choice in the two varieties. It is merely a matter of taste. There is no fowl that looks more neat than the white—*when kept neat,*—and they are a very attractive feature to a green landscape.

**White Leghorns.**—The White Leghorns were introduced into this country much earlier than the brown, and are consequently more widely disseminated. In England they are much more popular than the Brown variety, while in this country they seem to be regarded with nearly equal favor, with perhaps a little partiality in favor of the brown. As far as the economic value of the two colors is considered, we regard them as of equal value; the color being a matter of taste. Some fanciers consider the brown chickens more hardy than the white, while those with whom the white variety are the especial favorites, regard them as equally hardy with the brown. They are more easily bred true to color than the brown variety, as white feathers will unavoidably make their appearance now and then to disappoint the fancy breeders of the brown. For farm use, as egg-producers, or as poultry for the table, this is no essential objection; but to the bird fancier who is breeding for the show-pen, according to the recognized standard, it is an obstacle to be met in breeding birds of the purest blood.

It is only to be met by eliminating from the breeding pens, as often as they make their appearance, every bird with foul feathers, and retaining only those for breeding purposes that are true to color.

The White Leghorn is in plumage pure white throughout, with bright red comb and wattles, and white or creamy white ear-lobes. Its beak and legs are yellow. In the cock the hackle is very abundant, also tail coverts; while, like all the Leghorn varieties, the sickle-feathers are long and well curved. They are proud in carriage, and, like all the smaller varieties of fowl, are sprightly and active. They are a beautiful fowl in form, plumage, and symmetry, and well repay for the care bestowed in the abundant supply of eggs they furnish. In all respects except plumage they are similar to the Brown Leghorns.

**Rose-Comb White Leghorns.**—This is a new variety of the Leghorn breed in this country, that seems to do away with the objection so often urged by those living in a cold climate, against the single combs of the Leghorns, which are so liable to become frozen by our Northern winters, and also obviate the dubbing process so often resorted to as a choice between two evils, of "cutting or freezing," and which at best is a cruel practice to prevent a worse evil imposed by Jack frost.

In size, form, symmetry, and all respects except the comb, they are identical with the common White Leghorns.

By careful breeding, we shall doubtless have in time Rose-comb Leghorns of all the varieties of plumage now known. These would be better adapted to our colder latitudes than the single comb varieties. It only remains for the patient, persevering efforts of our experienced poultry breeders to bring it about, which can be done without detracting in the least from the characteristic merits of the breed.

**Dominique Leghorns.** — This variety has the general form and appearance of the Leghorn breed generally, except the plumage, which is of a light, slaty blue in ground color, with each feather distinctly penciled across with dark bars; the pure-bred fowl will have this uniform color free from white, black, or any other colored feathers. They are not as popular as the Brown and White Leghorns, owing probably to the fact that their plumage is not as pleasing to the eye possessing a fine taste for the beautiful in nature. They are, however, very hardy and good layers, which is the chief merit of the Leghorn breed generally.

**Black Leghorns.** — These were introduced into this country in the autumn of 1871, by Mr. Reed Watson, of East Windsor Hill, Conn. Subsequently, he made other importations. In 1878, he imported from Italy a fine cock, from which he bred most admirable and rare specimens of this variety.

Their general characteristics are like the other varieties of the Leghorn family, being noted for their laying qualities, vigor, hardiness, ease of raising, and beauty; and are highly valued by those who have raised them continuously. The color of the plumage throughout is a pure, deep black, that of the cock being very rich and glossy. Any approach to a red or brassy tinge in feathers is considered a grave defect. The large, bright red comb and wattles, and white ear lobes, making a pleasing contrast with the rich glossy black of the plumage, render it a very beautiful fowl. The beak is yellow, shaded with black; the legs a yellowish black, being nearly black in front.

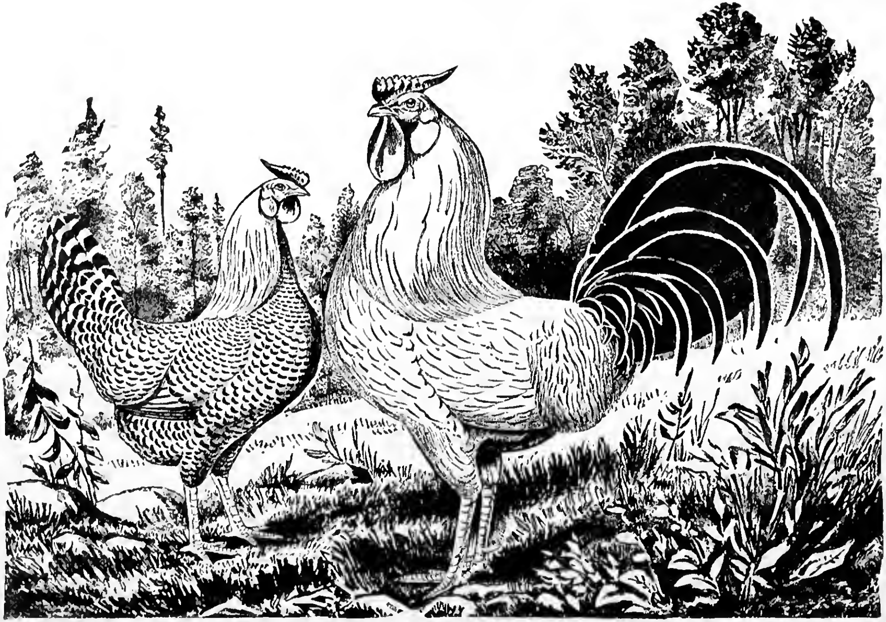
**Merits and Defects of Leghorns.** — The great merit of the Leghorns is, as we have previously stated, their superior laying qualities; in this respect they are unsurpassed. They are also very hardy, being less liable to the common fowl diseases than almost any other breed, and are consequently raised with ease and less care than would be required for many other breeds. They are non-sitters, consequently those who keep them are not troubled with the frequently recurring brooding propensity characteristic of most of the Asiatic varieties. They are great foragers, and this quality, combined with their small size, renders their keeping in summer less expensive than many of the larger and more docile breeds. Their activity with many may be deemed a defect, and such it would be, where confinement was necessary for lack of room, but where there was a range sufficiently extensive for foraging purposes, it would be rather considered a desirable quality.

As to their defects, the size of the comb, as we have previously stated in the description of this breed, is considered objectionable in our cold northern latitude, being so liable to freeze unless protected with warm winter quarters, and which when frozen greatly disfigures them, besides causing considerable suffering; but this would not be considered an objection in our more southerly latitudes, where the winters are more mild.

They are a very active, nervous fowl, consequently need the liberty of an extended range in order to thrive well, and where given the freedom of a farm, are inclined to wander farther than any breed of fowls with which we are acquainted. They are easily frightened, and not sufficiently docile in disposition to be very tame, and bear petting much. They are also very expert in flying over high fences, which renders limitation to their range sometimes a question of grave doubt, unless extra precautions in the height of the fence be given due consideration.

Their small size renders them unprofitable as table fowls merely, and where poultry is the principal desideratum, a larger breed of fowls would be more profitable and desirable; besides, their flesh is liable to be tough when over nine months old. Their eggs are small compared with those of the larger breeds, yet are large compared with the size of their bodies.

Taking all things into consideration, — the merits and defects, — where eggs alone are the main point in question, and there is plenty of room for foraging, as would be the case on most farms, and even in many localities in the towns and villages, we know of no fowl that we could recommend with more surety of giving satisfaction, than the Leghorns.



SILVER-PENCILED HAMBURGS. 

# HAMBURGS.

THERE are at present several varieties of fowls of the breed called Hamburgs. As to their origin Mr. Wingfield, an English writer, says: "Why Hamburgs should be called by that name is inexplicable, except upon the supposition that the Levant merchants then residing at Hamburg introduced them from Turkey or elsewhere, and that from Hamburg they were exported to England. By a similar transit Black Hamburg grapes derived their name, for they are certainly natives of Spain, imported by Hamburg merchants, and first known to Englishmen as Hamburg grapes because purchased by us there. Whatever may have been its place of origin, or however its present name may have been derived, it would appear that the Hamburg fowls were among the occupants of the poultry-yards of our monasteries as early as the beginning of the fourteenth century, since Chaucer has described a cock in their possession which was evidently of the Golden Hamburg breed."

The general characteristics of this breed of fowls are rather small size, the cock weighing from $4\frac{1}{2}$ to $5\frac{1}{2}$ lbs., and the hen from $3\frac{1}{2}$ to $4\frac{1}{2}$ lbs., beautifully penciled or spangled plumage, bluish legs, and brilliant red rose combs, rather square in front, running close and straight on the head, the top covered with little pointed projections and terminating in a spike behind, inclining slightly upward. Ear lobes white.

Their plumage is elegantly marked, glossy, and very beautiful, which combined with their graceful carriage and fine laying qualities. make them favorites wherever known. On account of the latter named quality they were formerly in England sometimes called "Dutch every day layers."

While this breed is too small to be a profitable table fowl, still the bones are small, giving more meat than could be expected from the size of the fowl, while it is of first-class quality and flavor. Their chief value is in egg production, laying most of the year except when moulting, as they are classed among the non-sitters. They naturally like a wide range, and are erratic in their propensities, yet they may be kept in confinement if strict cleanliness be attended to. We know of no breed that will suffer more from overcrowding and lack of cleanliness than Hamburgs. Six for one shed is quite sufficient in number if confined, and their surroundings should have careful attention.

They are capital winter layers, and though not as hardy, perhaps, as the Leghorn and Game-breed, still they are tolerably so, and will usually thrive well with good care. The principal recognized varieties of this breed are Black, Golden Penciled, Silver Penciled, Golden Spangled, Silver Spangled, and White.

**Silver Penciled Hamburgs.**—The once popular fowls known as Bolton Grays, are doubtless the ancestors of this breed, which, like those ancestors in the egg-producing qualities, rank among the best of the small active breeds in that respect.

We can give no better description of this beautiful variety of Hamburgs, than that given by Mr. L. Wright, to whose work on poultry we are indebted for the following: "The size of this exquisite breed is small, but the shape of both cock and hen peculiarly graceful and sprightly. Carriage of the cock very conceited, the tail being borne high, and carried in a graceful arch. The comb in this, as in all the other varieties, to be rather square in front, and well peaked behind, full of spikes, and free from hollow in the centre. Ear-lobe pure white, free from red edging. Legs small and blue.

The head, hackle, back, saddle, breast, and thighs of the cock should be white as driven snow. Tail black, glossed with green, the sickle and side feathers having a narrow white edging the whole length, the more even and sharply defined the better. Wings principally white, bnt the lower wing-coverts marked with black, showing a narrow indistinct bar across

the wing. The secondary quills have also a glossy black spot on the end of each feather, which gives the wing a black edging. The most frequent defect in the cock is a reddish-brown patch on the wing, which is fatal.

We believe this fault to occur nearly always in old birds, and remember seeing a cock which had taken thirty-seven prizes moult out thus at last, and so end his career as an exhibition bird. The bar on the wings is difficult to get, and is not imperative; any cock with a nicely edged tail, and quite free from colored or black markings on any part of the body, ought to stand a fair chance in exhibition, if form and comb be good. As a bird to breed from, however, he would be a failure; as it is impossible to get well-marked pullets except from a cock with a good proportion of black under-color.

The most frequent fault in the hen is a spotted hackle, instead of pure white. The rest of the body should have each feather distinctly marked, or 'penciled' across with bars of black, free from cloudiness, or, as it is called, 'mossing.' The tail feathers should be the same as the body; but to get the quill feathers of the wings so is rare, and a hen thus marked is usually valuable. Their general form is very neat, and appearance remarkably sprightly."

The ground color of the hen is pure silver-white; the back, breast, body, thighs, and tail having every feather evenly barred with black; wings the same, excepting the primaries, which are clear white. Care should be taken in selecting pullets for breeding that the feathers of the tail be plainly penciled with dark bars. The ear-lobes should be white, fitting close to the head. The beak should be silvery-white and rather short.

They are a truly beautiful bird, and have improved much by careful breeding, in the uniformity of plumage and other respects, since the commencement of the poultry show era.

In all Penciled Hamburgs the value depends mainly upon the exact and well defined marking of the plumage, which should be a dense black, and the color between, a clear silvery white. In the hen, the feathers are often so distinctly and evenly marked as to form parallel lines of black across the body of the bird. This is a little larger than the Golden Penciled variety.

**Golden Penciled Hamburgs.**—The form of this variety is the same as the Silver Penciled previously described, and the black penciling similar, the only difference being in the ground color of the plumage, which in that variety is a silvery white, and this, a rich golden bay. In this variety the color of the cock is much darker than that of the hen, often approaching a rich chestnut.

The tail of the cock is a greenish black, lustrous, and the sickle feathers distinctly edged with bronze or a reddish bay; sometimes the tail feathers are bronzed all over, though the former is considered the most desirable marking.

**Silver Spangled Hamburgs.**—The difference between the penciled and spangled plumage is, that while the former consists of parallel bars across the feathers, the latter have only *one* black mark at the end of each feather, which forms the spangle.

This black marking on the feathers varies in shape and size; the most popular and common are those with the round or moon-shaped spangles, which in some parts of England formerly gave the fowls the name of "Mooneys."

In this class the head of both sexes is silvery white, the hackle having each feather ending with a small black moon or spangle. The plumage of the body has each feather terminating with a greenish black moon or spangle, the size of the marking increasing with the size of the feather, which gives it a rayed or starry appearance. The spangles on the wing-covert feathers in both the cock and hen, form two distinct black bars across the wings. The sickle feathers of the cock are pure white, with a lustrous greenish-black spangle at the end of each feather. The feathers of the tail and tail-coverts are marked in the same way, giving the fowl a beautiful appearance. The hen is similarly marked. This variety has also the

rose-comb, as has been described in the general characteristics of the Hamburg fowls. The beak is blue, or horn-colored; the legs blue or slaty blue, and rather short. They are very active, upright, and graceful in their carriage, and among the most beautiful of our domestic fowls. Like all the Hamburg varieties, they are good layers of large white eggs, and non-sitters. It should be remembered by those not familiar with this breed, that many spangled Hamburg chicks are at first *penciled* in plumage, the spangles not making their appearance until after the first moulting.

**Golden Spangled Hamburgs.**—The principal difference between this variety and that just previously descriebd is in the ground color of the plumage, which, in this variety is a rich, deep golden-bay, the markings being quite similar, viz., each feather terminating with a distinct greenish-black spangle, round or moon-shaped, which should be quite large and regular in form. The hackle and saddle are a deep reddish bay, approaching a golden bay in color, with each feather distinctively striped down the middle with greenish black. The tail-feathers are greenish-black, and quite lustrous in the cock. They are admirable egg-producers: in proof of this we give the following experience of a breeder of this variety, Mr. Thomas I. Weir, of Wilmington, Del.:

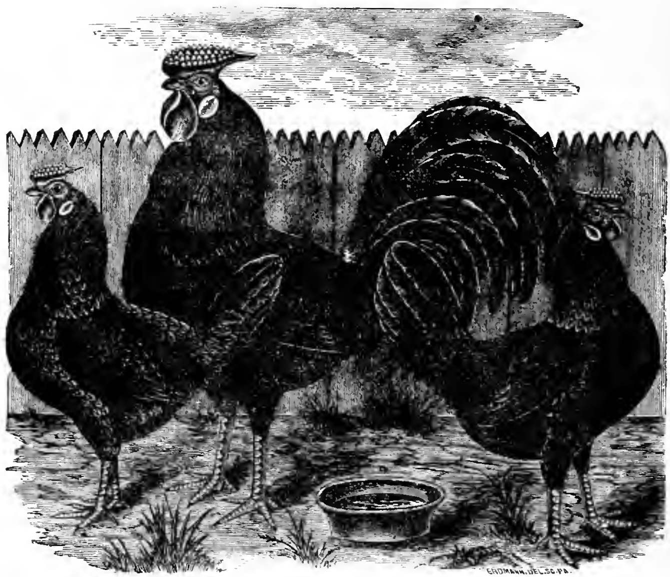
"I put together, March 1, 1876, two hens, three years old, and three pullets and a cock nine months old. All had been laying seven or eight weeks, but I only had a record of one of them to that date. I will here state that there was a difference in the shape of their eggs that enabled me to distinguish each hen's eggs from the others; I therefore gave each hen credit for what eggs she laid, and discovered that the young beat the old. All are now moulting except 'Little Nell.' She laid her first egg January 10, 1876, and fifteen during that month; in February, twenty-two, March, twenty-four; April, twenty-six; May, twenty-seven; June, twenty-six; July, twenty-seven; August, twenty; September, twenty-three; October, twenty, and to November 10th, six, making in all two hundred and thirty-six eggs in ten months for one hen.

The five, including 'Little Nell,' put together March 1st, laid, in six months, as follows: March, one hundred and eight; April, one hundred and twenty-one; May, one hundred and eighteen; August, one hundred and three; in six months, six hundred and seventy-four eggs for five hens. In May one pullet laid twenty-eight eggs. My Hamburgs were bred from imported stock." It will be seen by the above that hens of the Hamburg breed will lay well the second and even third winters, though of course not generally equal to the pullets. The cocks of this variety are slightly smaller in proportion to the hens than the other varieties of this breed.

**Black Hamburgs.**—It is supposed that this variety is produced by a cross with the black Spanish. They are slightly larger than other Hamburgs; cocks often weighing seven pounds, and the comb is also considerably larger. They, however, breed quite true to color, which is a rich lustrous black throughout. The beak is dark or nearly black, and the legs bluish-black. Their general form, symmetry, and points, are like the other Hamburg varieties, whose characteristics have been given under the heading of Hamburgs. This variety is said to produce larger eggs and more in number than the other Hamburgs, and are also more hardy.

**White Hamburgs.**—This is the least common of the Hamburg fowls, the penciled and spangled seeming to be the general favorites. They, however, possess the general traits of the breed, and of course come in for their share of merit among the Hamburg families. They are pure white throughout, and breed quite true to color. The beak and legs, as formerly bred, were a flesh color, but an effort is now being made, and quite successfully, to substitute the blue or leaden color for each, which has certainly resulted in a decided improvement to their general appearance. In economic value they are considered about equal in rank with other varieties of this breed.

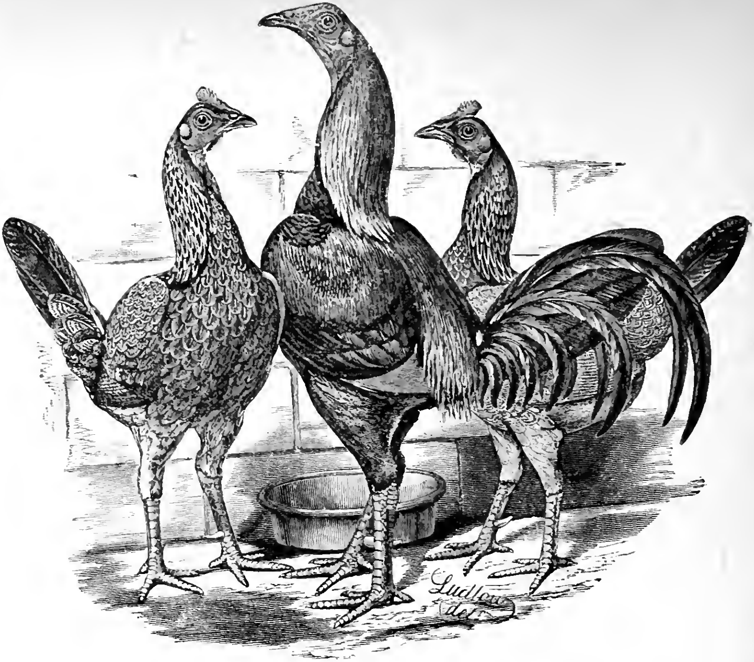
**Merits and Defects of Hamburgs.**—Since they are quite small, the consumption of food is proportionately small in quantity; hence the expense of keeping them is less than many of the larger breeds. They are noted for their egg-production, and are among the very best of winter layers; in fact, we doubt if any breed can excel them in this respect, though probably the Leghorns will equal them. They like best a wide range, and thrive most when allowed it, but can bear confinement very well if kept clean. They suffer from want of cleanliness more than almost any other breed; also from overcrowding, as we have previously stated. They are tolerably hardy, mature early, and will lay well through the second and even third winters. They are non-sitters, and give no trouble from broody inclinations, but when keeping them (as with all non-sitters), it will be necessary to keep a few others, such as the Brahmas or Cochins, to perform maternal duties to the young forthcoming Hamburgs.



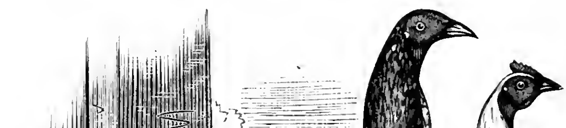
BLACK HAMBUROS.
Owned by W. Atlee Burpee, Philadelphia, Pa.

To the lover of the beautiful they are a source of pleasure, as the spangled and penciled varieties are perfect specimens of bird beauty, and cannot fail to excite the admiration of the beholder. They are also finely formed, and graceful in movements.

The greatest objection to them is their propensity to wander and fly; in the latter respect, they are perfect little "fly-aways," their small light bodies and strong ample wings making it perfectly easy for them to find the *other side* of a nine or ten-foot fence, when confined in a small enclosure. Mr. Wright says: "They may, it is true, be kept in a shed, but if so, the number must be very limited. Where six Brahmas would be kept, four Hamburgs are quite enough, and they must be kept dry and *scrupulously* clean." He also states that the penciled varieties are most delicate, being liable to roup if exposed to cold or wet, and for this reason it would be better not to have them hatched until May. The spangled are more hardy and



BLACK-BREASTED RED GAMES.
Owned by A. D. Warren, Worcester, Mass.



RED PILE GAMES
Property of E. H. Blackett, Lawler, Iowa.

lay larger eggs than the penciled, but not quite as many during the year as the latter. The Black Hamburgs are considered to be the best for egg production, of this breed. Their chief merit in an economic point of view is this quality, since their small size does not make them very profitable as a table fowl. Their eggs are large for the size of the fowl, and white.

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## GAMES.

THE very close resemblance in form, color, voice, combativeness in disposition, and courage, between the *Gallus Bankiva*, or Wild Jungle fowl of India, and the domestic Game fowl, have led naturalists to conclude with confidence, that the former is the parent of the latter. Many naturalists of note in India, including Sir W. Elliott, Mr. S. W. Ward, Mr. Blyth, Mr. J. C. Jerdon, and Mr. Layard, who are familiar with the Wild Jungle species, are of the opinion that most, or all of our domestic breeds have descended from this wild species.

Perhaps no fowl has been bred so extensively and with so much of real interest and enthusiasm, in both this country and Europe, as the Game; and perhaps none with regard to which so many and varied opinions have been entertained, and so great a variety of breeds have been produced; in fact, their number is so large, that we shall attempt in our limited space, to give only the principal ones. They are considered by many bird fanciers to be the most beautiful of all the domestic breeds of fowls.

Their leading characteristics are a strong beak, long, sharp, and well curved; head long, thin, and tapering to the beak, and very strong at its junction with the neck. The comb, when natural, — that is, when it has not been dubbed, — is small, single, low in front, thin and evenly serrated, and of a brilliant red color, in most varieties, though in a few, like the Brown-Reds, Blue, and Gray, it is a very dark red, often approaching a purple. The eyes are large and fearless in expression, which are indicative of their character and disposition; for they are the most courageous and pugnacious of all domestic fowls; in fact, a true Game seems to know no fear. The neck is long, very strong, and well arched; the hackle short and close, each feather of it being more broad than in other breeds of this size. The breast is broad and well rounded, the back broad across the shoulders, rather short and flat, narrowing towards the tail, and the body full at the sides. The saddle feathers are short, corresponding to the hackle. The tail should be of medium length, and carried rather erect and spreading; the sickle feathers having a full curve and long. The wings are very strong and of medium length, well fitted to the body, slightly raised at the shoulders, the points coming under the saddle feathers when folded, giving the body there a narrow appearance. The legs are set rather wide apart, are rather long, bony, clean, and very strong; the spurs set low, are long and sharp, and slightly curved upwards. The feet are broad and spreading, the toes long and furnished with long, strong nails. The entire plumage is short, compact, and glossy. The carriage is proud, upright, bold, and fierce.

The hen corresponds in general form to the cock, and usually has spurs. It is said that such hens breed the best cocks, as far as the fighting propensity is concerned. Their flesh is noted for delicacy of flavor, and they are ranked among the first-class layers, when provided with a good range.

Trevor Dickens, Esq., of London, who is one of the most noted authorities in England on all points concerning the Game fowl, says of them: "The Game cock, as the undisputed king of all poultry, requires more careful judging in regard to shape than any other bird. The Brown-Reds have long been considered the most perfect in outline. With respect to the

varieties of Game, the kinds which take nearly all the prizes and cups are the Brown-Reds, Black-breasted Red, Silver Duckwing, Greys, and Piles, all of which are cup-birds.

The original wild varieties of Game fowl are three: the Black-breasted Red, with fawn-breasted partridge hens; the Brown-breasted Reds, with dark legs and dark-brown hens, and the Red-breasted Ginger Reds, with yellow legs, and the hens of a light partridge color. These three colors were probably reclaimed at a very early period, and are still found in India as wild birds. From them all the other colors were originally bred; the varieties hatching dark chickens from the Brown or dark Reds, and all others from the other two sorts.

The best criterion of blood in all Game fowls, is the *color of the eyes*, a point which has been, strange to say, totally overlooked in every work on poultry hitherto published. *Black* eyes show dark blood, and the hens of such strains lay white eggs. *Red* eyes denote red blood, and lay pinkish eggs. *Yellow* or *daw* eyes lay yellowish eggs. These last are inferior in spirit to the others. Brown and bay eyes result from crossing different breeds.

The only kinds much used for fighting, are those with black or red eyes, and the three varieties now usually employed are the Brown-breasted Reds, Dark Greys (which are strongest and hardiest of all), and Black-breasted Reds, with *white* legs and dark red eyes."

The principal varieties of Games are Black, Black-breasted Red, Brown-red, Blue, Silver Duckwing, Yellow Duckwing, Ginger Red, Grey, Red Pile, White Pile, White, Spangled, White Henny Game, etc. Including sub-varieties, there are in all from forty-five to fifty varieties of this breed, which is the most diversified of all domestic fowls. Their name is truly "legion."

**Black-breasted Red Games.** — This variety of the Game breed is a great favorite, and considered by many as possessing qualities superior to the other recognized varieties. Be that as it may, they certainly possess great beauty of plumage, are very stylish, with a proud carriage, are very hardy, courageous, quick, and sprightly, and usually breed true to feather. It is the most nearly related in color and form to the original wild fowl of India, — the *Gallus Bankiva*, — of any of the Game varieties. As the general characteristics of the Game breed have been given at the beginning of this chapter, we will not repeat them here, but simply specify the points of difference in the varieties described, since the general description of the Game breed applies in a great measure to all the varieties and sub-varieties of that breed.

The color of the head of the cock is a very rich red, rather dark; the neck hackle of the same color, free from black stripes and very glossy. The ear lobes, wattles, and comb are bright red; the latter (if not dubbed) is small and thin, low in front, and serrated, standing straight and erect; the eyes are quick and courageous in expression, and quite large; in color, dark red or bay. The plumage of the body is usually a rich dark red, being rather darker than the neck hackle. The breast is black; any mixture of other colors there is considered a grave defect, indicative of the birds not being pure-bred. The under part of the body is also black. The wings are a rich dark red in the upper part, and a dark bay in the lower, with a metallic or greenish-black bar across them, formed by the wing coverts.

The thighs are also black, and the tail feathers greenish black; the sickle feathers and tail coverts being very lustrous. The saddle feathers, like the neck-hackle, are a rich red. The back is either willow or dark horn color. The legs vary in color. The American standard recognizes the willow, olive, yellow, white, and blue; but among the English fanciers the willow is the color preferred, where all other points of merit are equal, though all are recognized, if the plumage be unexceptionable and bright, and the eyes dark bay.

The general color of the hen is a rich, reddish brown; the hackle being of a brownish-golden color striped with black; the breast, a deep salmon color shading off to a brown; the plumage of the back and wings is a reddish brown penciled with black; the tail feathers

are very dark brown, almost black. Spurred hens are considered the best to breed from, but are not as commonly found in this variety as in the Brown-red. These (the Black-breasted Reds) are considered the best layers among the Game breed, though nearly all varieties have a fine reputation in this respect.

**Brown-Red Games.**—Of all the varieties of the Game fowl, this is the most esteemed by sportsmen in England, and is considered to be the most perfect in form of all; their symmetry and outline being as near perfection as is possible to attain in the poultry line. They have very dark red combs and wattles that incline in color to a dark purple; the beak also is nearly black, with all the fearless expression characteristic of the Game breed.

The color of the head is a rich dark red, changing to a shade lighter in the hackle, which is beautifully striped with black. The back is a dark crimson red; the saddle feathers striped with black similar to the hackle. The breast is a very dark reddish brown, deepening to nearly a black as it approaches the thighs. The wing-bows are a dark red; the coverts are a greenish black and very glossy; the tail a rich glossy black with greenish reflections. The thighs are nearly black, and the legs generally a dark willow, or bronzy black, with dark talons. The feathers are quite short on the body generally, giving it a close, compact appearance.

The general color of the hen is a dark brown. The back is nearly black, while the breast is quite black and glossy, forming a pleasing contrast with the hackle, which is a brilliant gold, striped with black. The feathers of the neck are so short that they give it a very slender and graceful appearance. The wings are very dark brown or black; the tail also is black. It is said by connoisseurs in poultry matters, that the best hens are generally spurred, and their tail feathers show a slight curve, but, like all dark-combed varieties, they are not as good layers as those with bright red combs.

**Ginger-Red Games.**—The general color of the plumage of this species is a rich red throughout; the breast, in color giving the name to the fowl, which is that of a ginger-red, which deepens in shade towards the thighs. The wings have a brownish-red tinge; the tail is black, and the head and legs are also dark. The hen's plumage is also a yellowish brown; the hackle being a golden yellow striped with black, while the tail is black. These are not as beautiful in color as many of the other varieties, and are not quite as largely cultivated as some of the more varied plumaged birds. They are, however, favorites with many poultry fanciers.

**Red Pile Games.**—Next to the Black-breasted Reds, the Red Pile Game fowl is counted by many as one of the most popular of the Game families. They have long been highly esteemed across the Atlantic, as one of their best varieties, and one rapidly gaining favor in our own country. They are quite hardy and breed true to color.

The head of the cock is a deep chestnut red; the hackle of a lighter shade, while the breast is white, penciled with red. The back is a rich red, also the wing bows; the saddle feathers match the hackle in color, and the wing coverts are white, edged with red. The tail is white; any black feathers in the tail being considered a great defect. The eyes are red, or brownish red. Mr. T. Dickens of London says: "The reddest Piles are the best birds; the prize pens should be selected with bright red eyes and white legs." The hackle of the hen is light chestnut with white in the centre of each feather; the breast is a chestnut red, slightly mottled and shaded to a white under the body. The remaining part of the body is white, slightly penciled with chestnut red; the tail white. As will be seen by the description, they are a very beautiful fowl, which, combined with other good qualities, has placed them first among the favorites with many bird fanciers. They are very superior egg-producers.

**White Pile Games.**—The hackle of the White Pile Games is white, with slight penciling of red; the breast white, also the tail and wings, except the wing coverts, which

are bright red; the thighs are white, like the main part of the body; the back light red, while the saddle feathers match the hackle. The legs are usually yellow, but sometimes white. The plumage of the hen is mainly white, except the breast, which is a reddish brown. Like all the Game breed, they are hardy, good layers, and make excellent mothers, protecting their chicks against every enemy that invades their realm. Though not as showy and beautiful in plumage as the Red Pile, previously described, still they are a very neat, attractive fowl, and need to be seen only to be admired.

**Silver Duckwing Games.**—The general color of the cock in this variety is silvery white, with a clear white hackle; any black stripes in the latter being considered by competent judges at the poultry shows, as decidedly objectionable. The breast, under part of the body, and tail are black, with a metallic or greenish tinge; the wings are crossed with a steel blue bar formed by the wing coverts. The ear lobes, comb, and wattles are bright red, and the legs willow or blue, sometimes nearly a bronze tint.

The hen is a silvery gray of a bluish tinge; the neck hackle a silvery white striped with black. The breast has a yellowish tinge, and the tail is very dark gray, sometimes nearly black. In a show pen for exhibition, the legs and beaks should of course match in the different birds; for instance, a willow-legged cock with a blue-legged hen, would not be considered in good taste. The blue-legged birds are considered by many to be most purely bred, and the eyes of such are usually dark-red or bay.

Silver Duckwings are purer in blood than the Yellow Duckwings, and can be successfully bred only by mating those of this variety without the introduction of any other blood, while the Yellow Duckwings originated by a cross between the Silver Duckwings and Black Reds, and are only kept up by occasionally introducing blood from the latter. They possess the fine qualities characteristic of the Game breed generally.

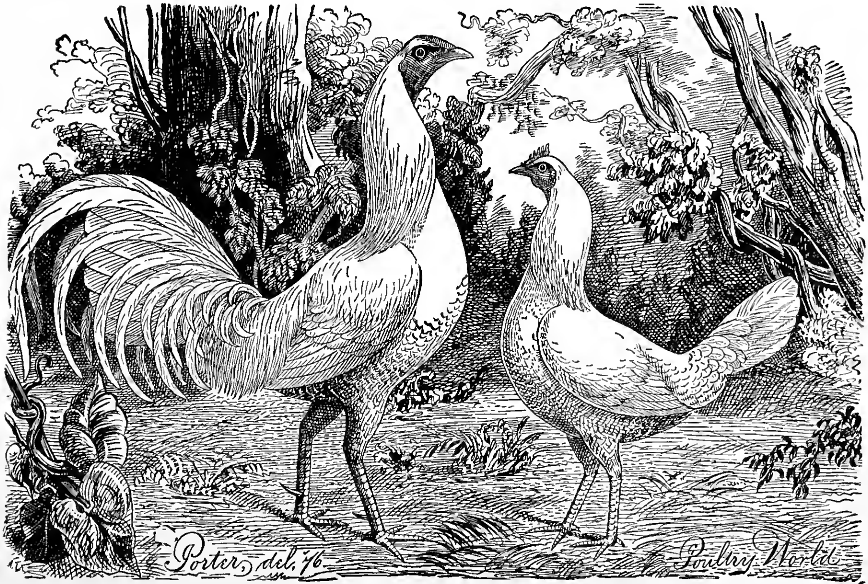
**Golden Duckwing Games.**—These are similar to the Silver Duckwings, previously described, except the straw-colored neck hackle, and saddle feathers, and the copper-colored feathers of the back. The plumage of the hen is considerably darker than the Silver, the back plumage being a slaty gray, and the breast a salmon-red shaded to a brownish gray towards the thighs. The plumage of both of the Duckwing varieties is very beautiful, and considered by some to be more so than any other of the Game species.

**Black Games.**—Other points of merit being equal, as a general thing, a black plumaged fowl does not attract as much attention as white or gayer colored ones, and are consequently not as popular, but a rich, lustrous black, with green or metallic reflections from which all the other colors seem to be half-hidden and half-disclosed as they gleam in the sunlight, is indeed rich and beautiful in the extreme; although the dead black or russet-black produces a very different impression. The red face and wattles also show a pleasing contrast with the glossy black plumage.

**Blue Games.**—Fowls of blue plumage are quite rare, and we are surprised that it should be so, since some of them are very beautiful, especially the Blue Games, the Blue Duns, and Cuckoo fowl; they are, however, more frequently seen in England than in this country.

The general color of this variety of game is dark-blue; the head and shoulders shaded slightly with black; the saddle feathers of the cock of a golden red or yellow; the wing coverts also have the same tinge. The tail is dark-blue, and the legs and beak of a bluish-black color. The general plumage of the hen throughout is a dark blue. The comb and wattles are a very dark red, approaching nearly to a purple. They are hardy and possess the merits characteristic of the Game breed in general, except, perhaps, are not quite as good layers as the bright red-combed varieties.

**Gray Games.**—As the name indicates, the general color of this variety is gray, or what might be more appropriately termed a silver gray, shading deeper into a black at the

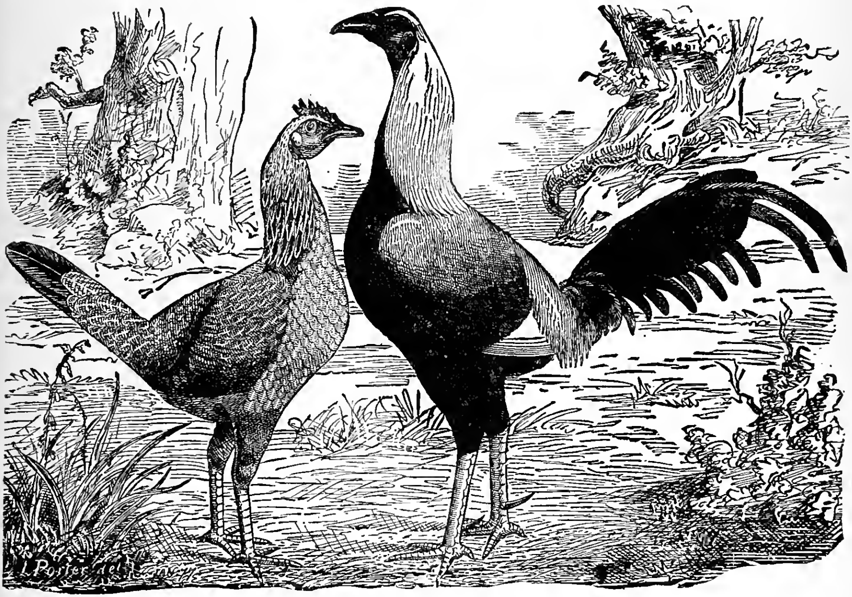



WHITE GEORGIAN GAMES.
Owned by C. S. Lincoln, Warren, Mass.

breast; the wing bows are silver gray like the body; the wing coverts a glossy black, also the tail. The beak and legs are dark; comb, ear-lobes, and wattles of a reddish purple tinge.

The hen has a more dusky hue than the cock, though similar; her hackle is striped with black, which gives the general appearance of being considerably darker than the cock. Like all the Game species, the plumage is quite glossy and attractive. They are not as good egg producers as most of the other Game varieties.

**Spangled Games.**—There seems to be no specific or well-defined standard as applied to this species, since we find them of all colors combined with white. The two varieties most attractive in plumage are the black and white, and red and white, though blue and white, buff and white, and brown and white are often seen. Though not as popular as most of the



GOLDEN DUCKWING GAMES.

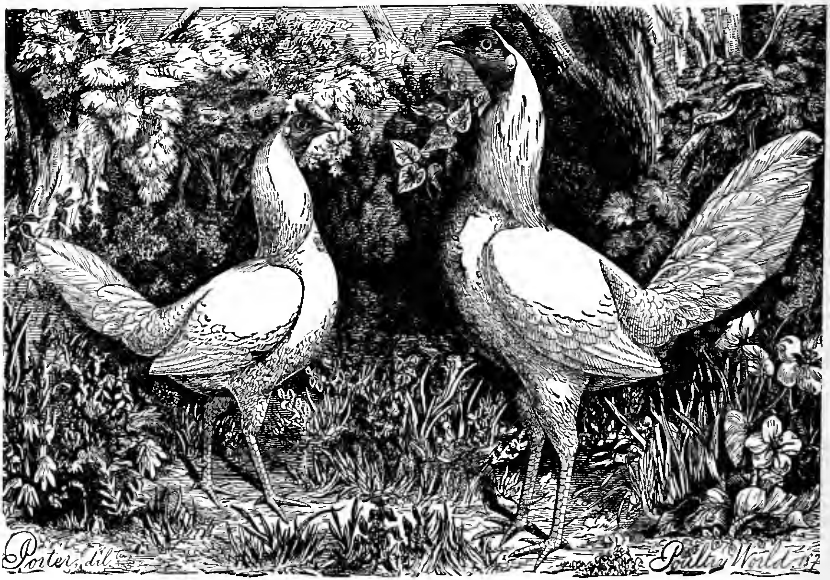
other varieties of Games, still, like all spangled fowls, they are attractive and pleasing in appearance, some of them being very beautifully marked. The comb and wattles are bright red. As layers, they equal any of the Game varieties, and deserve to be more generally known, since by that means they would be more fully appreciated.

**White Games.**—These fowls are in plumage a pure white throughout in both sexes, and their appearance, like all pure white-plumaged birds, is very neat and attractive. The eyes are red, and the legs are usually yellow, though sometimes white, either variety being considered pure bred. Any yellow or colored feathers are considered an indication of impure blood, and a great defect. They are quite vigorous and hardy.

**Henny Games.**—This is a peculiar species of Game in which the cock is feathered like the hen. These fowls are favorites in some parts of England, but are not as common in

either England or America as most of the other Game varieties. They are larger and heavier than the other Game species, and are of various colors,—red, white, black, gray, etc. Mr. Wright says of them:

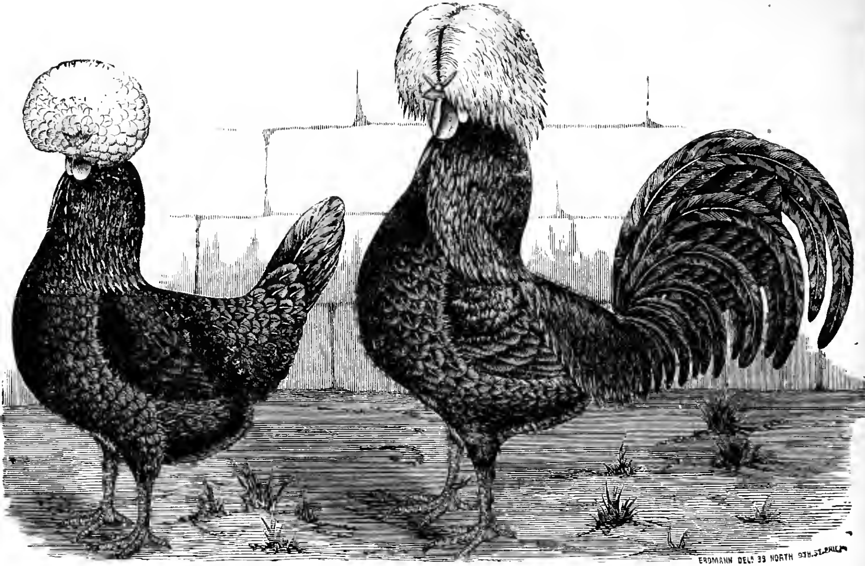
"On the whole, the probability is that the breed is descended from some very ancient progenitor, which accidentally exhibited the peculiar hen-plumage and struck the fancy of its progenitor. In Laced Bantams, which are known to have derived their hen-tailed character from a single cock which took Sir John Sebright's preference (and which was, very probably, itself descended from hen-tailed Game), we see how apt the feature is to transmit itself with a little care; and that our supposition is correct, and that the strain once formed was preserved sedulously apart from a period now impossible to determine, is rendered further probable by



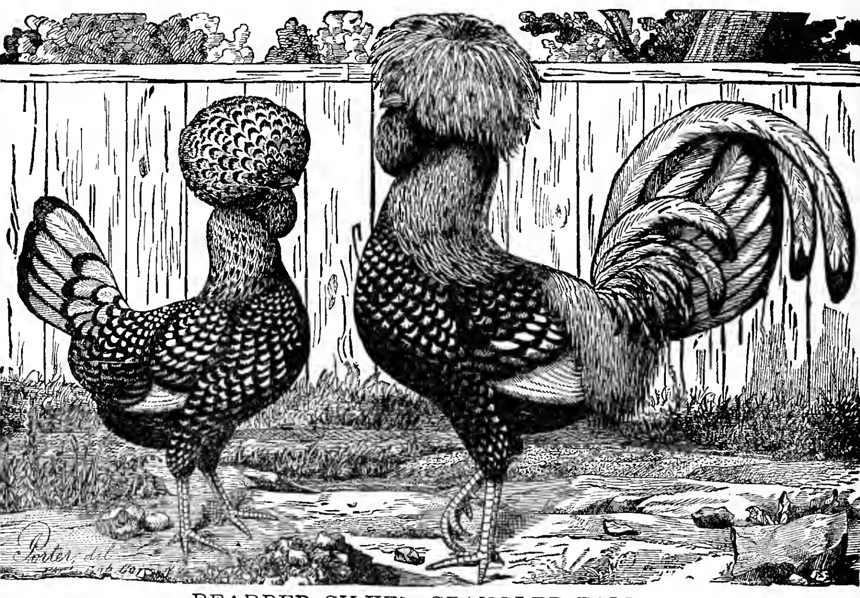

WHITE HENNY GAMES.
Owned by Dr. C. S. Betts, Mt. Kisco, N. Y.

the different colors and style of birds, which are very different from the standard breed of Games."

Dr. Betts, an importer and breeder of Henny Games, says they are the most difficult to obtain pure of all the different Game varieties. The accompanying illustration represents birds of a pure white plumage with yellow legs. The true bred Henny cock lacks the very distinctive feature of sickle-feathers in the tail, and when an occasional bird, said to belong to this family, produces the sickle-feathers common to other breeds, there is reason for supposing that there may have been an antecedent cross, and such birds should be rejected from the stock-pens, since contamination would assuredly show itself in the progeny. This variety is said to be a fine table fowl, and very hardy.




WHITE-CRESTED BLACK POLISH.




BEARDED SILVER SPANGLED POLISH.
Fowls Bred By Chas. Gammerdinger, Columbus, Ohio.

**Merits and Defects of Games.** — In beauty of plumage, hardiness, elegance of form, boldness, and courage, they are unrivaled, while as egg-producers, they are classed among the best, provided they have sufficient range. They are also next to the Dorkings (which are considered *best* of all) in delicacy of meat flavor, although their small size, as we have previously stated, would not render them a profitable fowl to keep for the market. Many consider them equal and even superior to the Dorking in this respect, yet we think the majority would decide in favor of the latter, though the difference would be slight. They are most admirable mothers, taking the best care of their chicks, and will defend them against any foe that may intrude, even at the sacrifice of life. They will also attack hawks with the utmost fearlessness, whenever the flock is assailed.

A recent incident of the kind came to our knowledge. A gentleman who was breeding pigeons and Game fowls, noticed one day a large hawk hovering over his premises, and shortly after saw it make a descent upon a flock of his pigeons. The pigeons seeing the danger, flew towards their house, all but one, that was not quick enough, for the hawk seized him and was spreading his wings for flight with his prey, when a young Game cock near by flew at him with such fury that the first blow of his sharp, long beak broke the hawk's wing, and he was easily made a captive. He proved to be an unusually large bird of his kind, and the wonder was that the little Game fellow could have accomplished his work so quickly.

Although we do not approve of pitting Game fowls, yet where there is a Game cock on the premises, there is no danger of intrusion from others. If they did attempt it, they would soon be reminded of "Home, sweet home," with the desire to be there as quickly as possible. Their pugnacity and fearlessness is truly remarkable, attacking any intruder, though he may be three or four times their own size, and what is more remarkable still, will be sure to be victorious.

The Game is too restless to bear confinement, and should never be fattened like other fowls. They eat but little, being of small size, and therefore are economical birds to keep; their eggs, however, are quite small. When confined they will not lay as many eggs as many of the other breeds of larger size, the Brahmas, Cochins, Hamburgs, or Spanish, and should have plenty of range if practicable; they are also less liable to fight among themselves, if allowed sufficient range.

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## POLISH FOWLS.

THE Polish fowls are distinguished by a crest or tuft of feathers on the top of the head, which adds much to their beauty; as an ornamental, and at the same time useful fowl, they are classed among the favorites of the bird fancier. They are non-sitters, and prolific layers of a moderate-sized egg, and with good care will lay well through the winter. Being a little sensitive to the wet and cold, they should always be provided with warm, dry quarters; though not as hardy as some breeds, yet with a little care they can be very successfully raised. They are plump-bodied, of rather small size, the weight of the cock being, on the average, from five to six pounds, the hens from four to five pounds. They are very stylish fowls, and of graceful contour. The feathers in the crest of the cock are pointed at the extremity like the neck hackle, while those of the hen are broader and round at the end. By this difference in crest, the difference in the sex of the partial grown chickens can be determined; while the size of the protuberance at the top of the head in chicks just out of the shell, it is said, will determine the comparative size of the crest in the full-grown fowls; that is, the largest protuberance will produce the largest crests, which are considered as pertaining to the best birds.

The comb of the Polish fowl is very peculiar, and resembles two little horns, something like the letter V in form; it is, however, quite small, and often entirely disappears in the bearded varieties. The principal varieties of this breed are the White-crested Black, Black-crested White, White, Golden, Silver, Bearded Golden, Bearded Silver, and Bearded White, though there are several others that are known, but are not common.

It is claimed by some that these fowls derive their name, not from Poland, but from the peculiar poll or crest of these birds; others, from the fact of their white crest resembling the tuft of white feathers worn by the Polish soldiers. However this may be, they are certainly a very stately and beautiful bird. The White-crested Black are the oldest and best known variety of the breed. They are docile in disposition, and fond of being petted. At poultry shows they always attract a great deal of attention.

**White-Crested Black Polish.** — This is the most common variety of the Polish breed, and also the most generally admired; the contrast between the glossy black plumage and the white crest of the bird, combined with their graceful form and docile disposition, rendering it quite attractive. The crest is not always a pure white throughout, however, for it frequently happens that the lower feathers at the base of the crest, sometimes called the beard, are black, especially in front; the fewer of these black feathers, however, the better, according to the opinion of poultry judges. The birds should always be provided with shelter from the rain and wet, as they have a tendency to roup; besides wetting gives the crest a soiled and bedraggled appearance, causing it to fall over the eyes, sometimes in such a manner as to nearly obscure the sight. The comb is bright red, small, horned in shape, as described in the general characteristics of the Polish fowl; the ear lobes white, and the beak dark, with large open nostrils.

The general plumage throughout is black, the irdescent character of which renders it very beautiful. When seen in the bright sunlight, all the mingled hues ever known seem to be half hidden and half revealed, and cannot fail to excite the admiration of those least interested in poultry matters. The body is full and plump, the tail large and carried quite erect. The legs are dark. The general carriage proud and erect, the neck being thrown back towards the tail. As we have previously stated, the crest of the cock is similar to the hackle feathers; that is, each feather being narrow and pointed at the extremity, while that of the hen is more compact, each feather being broader, and round at the end. They are very good layers, and considered among the best, though there is quite a difference in individuals in this respect, some hens being much more productive than others. The eggs are of medium size.

Mr. Edward Hewitt, the celebrated English connoisseur in poultry matters, says: "For the guidance of those who may adopt Black Polish fowls as their future favorites, it will not be out of place to throw out a few suggestions that may prevent annoyance and loss to the inexperienced. The chickens are apt to dwindle from perfectly robust health, drooping the wings and dropping off at from five to six weeks old. This is their trying time, and once safely got through it, they then become as hardy as most descriptions of fancy poultry. A little extra care as this time draws nigh, with the addition of chopped cheese, crushed hemp seed, and maggots from stale flesh, *well scoured* for a few days in bran to cleanse them from impurities, I always found would bring them safely out of their difficulties.

Another circumstance worth naming arises from the natural timid character of young Polands, when the crests are fully developed and they have not been accustomed to be handled. If taken up unexpectedly from behind, I have, to my chagrin, known several cases of them dying instantly, although most tenderly handled; the head suddenly dropped, a slight gurgling sound in the throat, and the most valued specimens were dead. This evidently arises from sudden alarm, as they cannot see coming danger from the rear when the crests are fully developed, and such accidents generally take place when the chickens have hitherto

been subjected to no restraint on a wild country walk. If spoken to soothingly *before* taking them in hand, this mishap is altogether obviated.

Among full-crested cocks annoyances frequently arise from the hens eating away the centre-feathers of the crest while yet immature. This evil practice, once acquired, is difficult to repress, the fact being, the cocks stand perfectly still and allow the young feathers to be eaten away piece-meal, as though not susceptible of pain even when the blood is flowing freely. The only course appears to be rather by prevention than remedy, viz.: to fasten the cock up separately for a few days during the time the crest-feathers are being reproduced, for when matured, even the same hens rarely continue this vexatious habit. Sometimes, when cocks have been thus repeatedly plucked by their companions, I have known the crest-feathers reproduced *beneath the scalp* (being unable to force a passage). This unnatural growth is frequently attended by severe local inflammation and even death. I had, some years back, two or three cocks, thus suffering, experimented upon by a medical acquaintance, the result being, that though he saved their lives, their crests were ruined."

The crests in perfect specimens of these birds are large and full, even in the centre, and in the hen nearly globular in form, being more compact than that of the cock, as the feathers are broader and round at the end. As a few black feathers will often make their appearance in the crest, it is frequently the case that birds are found at poultry shows having these feathers trimmed out or plucked, which, when detected (and with competent judges they usually are), disqualifies them at once from competing for prizes, as such deception and trickery ought to be discountenanced.

**Black-Crested White Polish.**—This beautiful variety of Polish fowls is at present almost unknown,—a fact greatly to be regretted, both on account of their rare beauty and economic value, as English writers on poultry mention them as being the largest and most hardy of the Polish family. They were formerly very common. It is hoped that more successful efforts will be made to revive this species among poultry breeders, for, from descriptions, it must have been the most valuable variety of this breed. They possessed the general characteristics of the other varieties, except they were much larger, the plumage of the body being pure white, and the head surmounted by a large black crest. They were extremely valuable as egg-producers, also as a table fowl, while their extreme hardiness obviated the now common objection to the present varieties of this breed.

**Golden Polish.**—There are two varieties of both the Golden and Silver Polish, viz., the bearded and unbearded; the former being more attractive, perhaps, the beard being a very unique marking in fowls, and a fitting counterpart to the beautiful crest of the head. The color of the crest of the Golden Polish is similar to the hackle, being a golden-bay with black lacing; the larger the crest the better, but it should not fall over the eyes so as to obstruct the sight. It should rise well in front, falling over at the sides and back with no division in the middle. The ear-lobes to all the Polish varieties are almost without exception white; the beak and legs dark, the latter being a kind of slaty blue, which are quite apt to grow lighter in color as the bird gets older. The general color of the plumage is a rich golden-bay, each feather marked with black, in the form of a spangle or lacing, the marking increasing in size with the size of the feather.

The ends of the wing-coverts have a large black spangle, which forms across the wings two distinct black bars when folded; these features also have a narrow lacing of black on the edge. The sickle-feathers and tail-coverts are also a golden-bay, each feather ending with a large black spangle. Like all spangled and penciled fowls, the marking of this variety is very beautiful. Their characteristics are similar to those described as applying to the Polish breed generally, though they are somewhat larger than the White-Crested Black variety, and are considered by most breeders of experience to be also more hardy. As the crests of all the Polish family are their main characteristics, those having the largest and most

perfectly formed, as well as desirable colored crests, should always be selected for the show-pen, or breeding purposes. A cock with an inferior crest is more apt to stamp this defect upon his progeny than a hen with a similar defect, but it is always safest and best to select those of both sexes having a large, perfectly-formed crest, since the result will be more satisfactory.

There is always a tendency to breed a little lighter; therefore for breeding purposes the darkest-colored birds should be selected, and the marking should be very distinct. They should be kept in dry soil, and always give more satisfactory results with plenty of range, though they bear restriction in this respect tolerably well. They never sit, consequently some other small fowl, like the Game, should be kept for incubating purposes. The young chicks should not make their appearance before the early part or middle of April, as they are rather delicate.

**Bearded Golden Polish.**—These are similar to those previously described, with the exception of the beard, which is a golden-bay, laced with black, making a black border around each feather; the feathers being small, give the beard of the cock a darker appearance than the rest of the plumage. It is full and heavy, and extends in a curve back of the eyes. This variety is said to be more difficult to breed true to all the points than the non-bearded. They are very docile and fond of being petted, like all the Polish varieties. The weight of the cock is from five to six and a half pounds; that of the hen from four to five and a half pounds. The best bearded strains of these fowls have neither comb nor wattles. The crest of the bearded Polish is generally larger than the non-bearded.

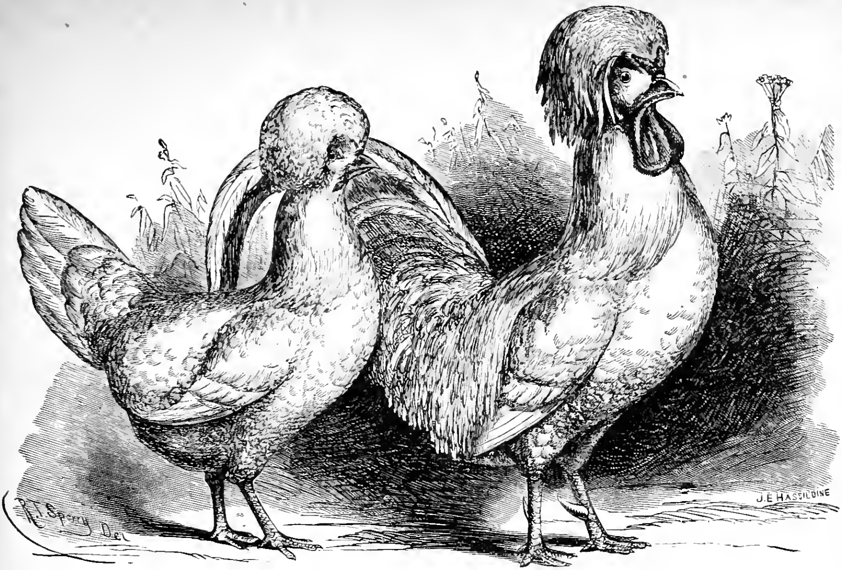
Within the last five or six years the bearded varieties have grown in popularity in this country, and will in time, we think, entirely supplant the non-bearded. In England they are altogether more popular than the latter (which are now seldom seen), from whence importations are frequently being made by our poultry fanciers, and there is little doubt that this beautiful variety will soon become equally common in our own country.

**Silver Polish.**—In this variety the marking is the same in every respect as the Golden Polish, previously described, except that the ground color in this variety is silvery white, instead of golden-bay. The general form, size, etc., are also similar to that variety. The crest is a silvery white, tipped or laced with black, but as the birds grow older the crest-feathers grow lighter, and in very old birds sometimes appear nearly white. The hackle is also a silvery white, laced with black, which is the uniform marking of the plumage of the body. The marking of the wings in two distinct black bars is also the same as previously described in the Golden Polish.

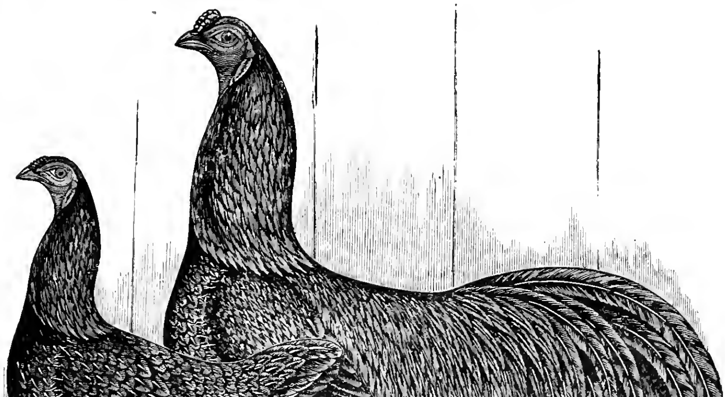
The tail is silvery white, with a black spot at the end of each feather. In many birds the feathers of the tail have a lacing or border of black around the edge, aside from the spot at the end, similar to the wing-coverts, and we think this marking adds much to their beauty. As in the Golden variety, the more distinct the marking, and dark the plumage, the better for breeding purposes, since the lighter marked birds produce chickens marked too light for beauty or desirability for the show pen. The beak is horn-colored; the legs, like all the other members of the Polish family, are a slaty blue.

The crest should be large and globular; that of the hen should be round as a ball, with no parting whatever in the middle. As the crest-feathers of the cock are longer and narrower than those of the hen, they will not be quite as compact, but should be globular in general outline.

**Bearded Silver Polish.**—This variety is precisely like the Bearded Golden in marking and general characteristics, except in the ground color of the plumage, which is a silvery white, laced with black. The marking in all good birds is distinct and uniform. The beard should be full and dark, every feather of which should be tipped with black, like




**WHITE CRESTED POLISH.**
Owned by H. T. Sperry, Hartford, Conn.



**BLACK SUMATRAS.**
Property of J. G. Bicknell, Buffalo, N. Y.

the hackle. After the first moult the feathers are generally somewhat lighter. They have a beautiful plumage, and like all the Polish varieties are highly prized for their ornamental as well as useful qualities. We might add respecting the crest of this variety, that the first year the feathers are black, finely laced with white, after which the color is reversed and is white laced with black. The lacing is slightly heaviest at the tips of the feathers throughout the plumage.

**White Crested White Polish.**—These fowls possess the general contour and characteristics of the other Polish varieties described, but are somewhat larger in size than any other except the Black-Crested White, which is the largest of the Polish family. They are more hardy than the colored varieties, and breeders of experience consider them more prolific in egg-production. The plumage requires no description, being a pure white throughout. The ear lobes are white, comb and wattles bright red; the beak dark, with large nostrils, which are peculiar to the Polish breed; the legs a slaty or dingy blue. They are very erect and proud in carriage, docile in disposition, making the most gentle and affectionate of pets. They are hardy and healthy when pure bred, yet the quickest of all fowls to show the deteriorating influence of a cross.

**Bearded White Polish.**—This variety is similar in all respects to the White Polish previously described with the exception of the beard, which is quite full and abundant, and like the entire plumage, a pure white. The crest of this variety is the largest and most perfect in form of all the Polish family. They are comparatively hardy, and like the other White variety, among the best layers of the breed. As a table fowl, they are plump, fine-flavored and delicate, and are quite easily fattened. The wattles and comb are nearly concealed by the crest and beard. Like all pure white fowls, they are very neat and attractive in appearance. They breed true to color, but where black or yellow-tinted feathers make their appearance, they are considered a defect by judges at the poultry exhibitions, other things being equal, the pure white plumaged birds bringing the highest prizes.

**Merits and Defects of Polish Fowls.**—The merits of this breed have already been mentioned in the descriptions previously given. They are among the best layers; being non-sitters they lay almost constantly with good care, except when moulting. In fact, some cases occasionally occur among them where the hen from excessive laying becomes so weakened and reduced, that consumption results, becoming thus emaciated, she droops and finally dies. The flesh is very fine for table use. plump, tender, and juicy, and is easily fattened. They are gentle and docile, easily tamed and fond of being petted, and seem peculiarly susceptible of attachment to those having the care of them. For this reason they are especially adapted for ladies' fowls, which quality, combined with their beautiful form and plumage, make them generally the favorites with their owners.

Mr. Wright, in his "Illustrated Book of Poultry," says of this breed: "They are perhaps of all breeds the best adapted to thrive and be happy in *strict* confinement, that is, if the sole run be a wired in and covered shed. Provided such a shed be kept very dry in the floor, and very clean, Polish will thrive and look well in it; of course, supposing the necessities of diet be attended to. Lime rubbish mixed with sand or gravel makes an excellent bottom for them; and if kindly treated, they become almost immediately as tame as cats."

Special precaution is necessary in rearing Polish chickens, owing to the prominence of the skull which supports the crest, and which is peculiarly sensitive to injury, never being completely covered with bone. For this reason, heavy hens, like the Brahma or Cochins, should never be employed as mothers for this breed. The greatest objection to these birds is a tendency to roup; but where care is taken to provide dry, warm quarters for them, this difficulty can be entirely avoided. They should be provided with shelter, and be shut into an

enclosure during a shower, since wetting the crest greatly mars its beauty, besides causing it to fall over the eyes and thus obstruct the sight. The crest and beard serves as a protection against frost to the comb and wattles. They should always be gently handled, and never suddenly frightened, as they are often frightened to death by being suddenly seized without being aware of a person's approach. There are other varieties of this breed described by different writers, and sometimes seen, such as the Buff or Chamois Polish, Blue, Gray, Black, and Cuckoo, etc., but these are very rare.

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## SUMATRAS.

THIS breed, although introduced into this country about thirty years ago, has never been extensively bred here. They formerly varied much as to color of plumage, but are now mostly bred pure black. They were formerly known by the name of "Sumatra Games," "Sumatra Ebon Games," "Sumatra Pheasants," and "Sumatra Pheasant Games," to distinguish the different colors. As the name indicates, they are natives of the island of Sumatra, and are a small active bird, and in some respects slightly resemble the Game species, yet are materially different from them. They have been described as resembling in form the wild Pheasant, more than any other fowl, especially in the length of the tail. The head is broad with small comb and wattles, which are bright red.

The comb is what is called a "pea comb;" the beak strong and powerful, eyes lustrous, quick, and fiery; the birds generally indicate something of wildness in look and manner. The neck is long and gracefully curved, the breast broad and well rounded, the legs slender and symmetrical, with powerful thighs like the Game. The plumage is rather compact and black, with beautiful metallic reflections. The tail, which is the most noticeable feature of the bird, is, in the language of Dr. Bennett, who received the first importation of them into this country, "very long and flowing, with abundant plume and sickle feathers sweeping the ground, and in this respect, more closely resembling the bird of Paradise than any other of the gallinaceous race." The legs are unfeathered, and the cocks sometimes have even two or three spurs.

**Merits and Defects of Sumatras.**—These fowls possess the most lustrous and beautiful plumage of any black colored fowl we have ever seen; are good in egg-production. and are a good table fowl. They are, however, restless if confined, and will fly almost equal to a pigeon; consequently a very high fence is required to keep them within an enclosure. They breed quite true to feather, though an occasional white or red feather will sometimes appear, as in nearly all black plumaged birds.

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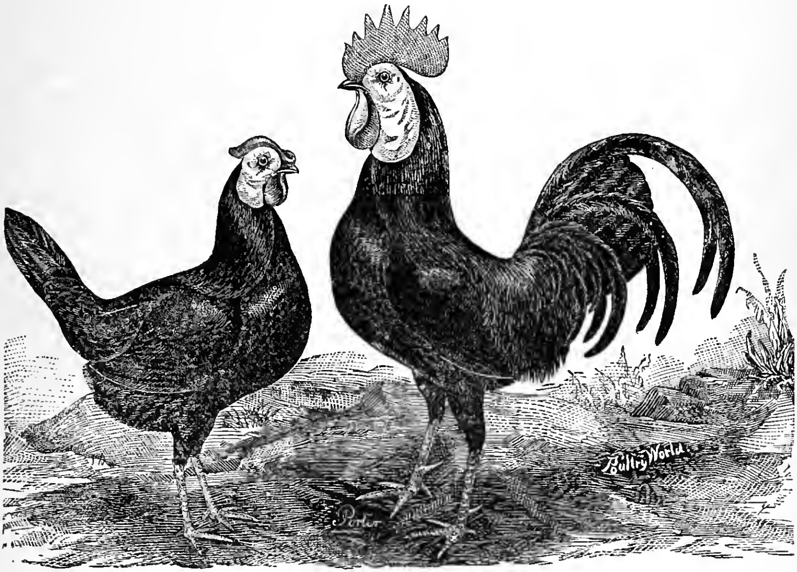
## SPANISH.

THE Spanish fowls have long been so popular in this country and Europe, and their merits so well known that a lengthy description here is unnecessary. Their symmetry of form, graceful and proud carriage, as well as beauty of plumage, have made them favorites with poultry fanciers, while their real value as egg-producers, combined with the former, have placed them among the most desirable breeds. Their flesh is of very good quality. Their eggs are large and white, and are said to exceed in weight those of any other breed, except the La Flèche. The Black Spanish is the most important variety of this breed,

and also the most common; the others are the Minorca or Red-faced Black, Ancona, and White. The average weight of the Spanish cock is about seven pounds, though sometimes they weigh eight. The average weight of the hen is about a pound less than that of the cock. They usually weigh more than they would seem, as they are full-breasted and plump-bodied, and have rather long legs. They rarely sit.

**Black Spanish.** — The most important feature of this variety of the Spanish breed is the white face, which gives the fowl a very unique and peculiar appearance. It should be an opaque white, smooth and free from wrinkles or any red spots. It extends over the entire surface from the base of the beak towards the back of the head; the wider and deeper, the more




BLACK SPANISH.

desirable. It is arched-shape above the eyes, reaching nearly to the comb, and extends below the depth of the wattles in length upon the neck, and joins the latter with the ear lobes, meeting under the throat. The comb is large, single, and deeply serrated, of a bright red, forming a striking contrast with the white face and glossy black plumage. The ear lobes are white and large; the wattles bright red like the comb, and very long and pendulous. The general color of the plumage is a rich, glossy black with lustrous reflections. The tail is carried rather upright, and the sickle feathers long and beautifully curved. The beak is a dark horn color; the legs a dark lead or blue in color.

Sometimes white feathers will now and then make their appearance, also red spots in the face. Such birds should be discarded from the breeding pen, as the common rule of Nature, that "like begets like," will make these birds, as propagators of their race, very unprofitable, where pure bred fowls are desired. The hen is in color and general marking similar to the cock, except that her plumage is not quite as glossy. This is the most popular and valued variety of the Spanish breed.

**Minorca, or Red-faced Black Spanish.**—This variety has long been a great favorite in some parts of England, but is quite rare in this country. With the exception of the color of the face, it much resembles the Black Spanish previously described, having the same plumage and otherwise general appearance. It is slightly larger, however, and more hardy than the Black. It is also considered the best layer of all the Spanish varieties.

**Anconas.** — This variety is mottled throughout in plumage, or is what is often called "cuckoo colored," and presents a very neat and attractive appearance. They resemble the Minorcas in other respects, but are somewhat less in size generally. They are seldom seen in this country, being better known in England.

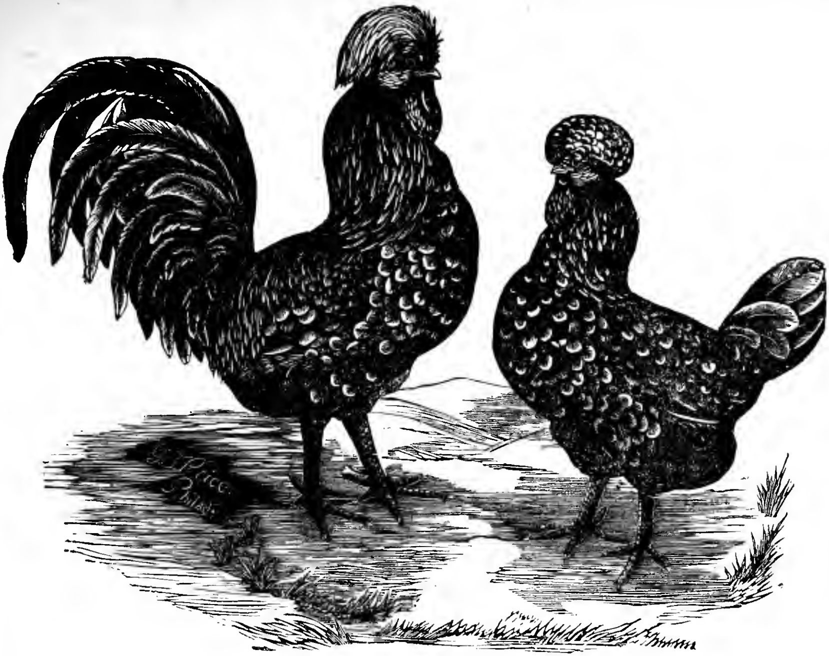
**White Spanish.** — This is similar to the Minorca variety, except in color of plumage, which is a pure white throughout. It is not considered quite as hardy as the Black, and is less common. It is, however, like all pure white plumaged fowls, — a very attractive bird, and quite conspicuous on a green lawn. Like all the Spanish varieties, it is quite proud and aristocratic in its bearing.

**Merits and Defects of the Spanish Fowls.** — The chief merit of this breed is in egg production, which is abundant, and the eggs of large size. As we have previously stated, the size of the eggs exceed those of any other breed, except the La Flèche, of the French breeds. They are, however, not good winter layers, unless provided with very warm quarters, such as produced by artificial heat. As a table fowl they possess considerable merit, but are not equal to the Game or Dorkings in this respect. As a "fancy" fowl, of course, the most popular will be the most profitable, since such are in greater demand, consequently the Black or White-faced variety will be the most profitable of the Spanish fowls. As a breed, they are rather delicate, compared with some others, and should always be provided with a warm house to protect them from inclemency at all seasons. Mr. Wright says of them, "to send fowls of this breed to winter shows in a basket not lined, in severe weather, is almost certain death." We should hope that any fancier who cared sufficiently for his fowls to send them to a poultry show, would also care enough for them to send them in a manner to be comfortably protected from the cold.

## FRENCH BREEDS.

FRANCE has long been noted for its enormous production of eggs and poultry, to which its fine climate is especially adapted. Probably no country in the world is better suited to the raising of poultry, and no country where it is so extensively produced in proportion to its population. While many of the French breeds are somewhat delicate when exposed to our colder and more changeable climate, still in time they seem to adapt themselves to it in a great measure, and when better acclimated, become quite hardy, as the Houdans for instance, which is probably the most popular of the French breeds, although the Crève Coeurs and La Flèche are rapidly gaining in favor. The principal or most popular of the French breeds in this country are those already referred to, viz., the Houdans, Crève Coeurs, and La Flèche, although the Breda or Guelders and La Bresse are much prized in some parts of Europe, especially in England, and are well adapted to that climate.

**Houdans.** — This seems to be in our country the most popular and hardy of the French breeds, although the Crève Coeurs are mentioned by some writers as being the one most preferred in France for the quantity and quality of its flesh. They produce eggs in great abundance, which are of large size and white, while they are capital winter layers, with



HOUDANS.


CREVE CŒURS.

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even ordinary care. Their flesh is also very fine, which has gained them the name in England of "The French Dorkings," the Dorkings being considered the *best* of all table fowls by the English. The cocks will weigh, on the average, from seven to nine pounds, and the hens from six to eight pounds. In size, form, and quality, this breed resembles the Dorking, the body being bulky and plump, with breast deep and full, and back broad.

The general plumage is black and white evenly intermixed, or as some have represented, "black and white spangled;" the crest, beard, and hackle being of the same color. The crest is not as large as the Polish fowls, and though full, falls backward, leaving the comb exposed, and not obstructing the sight. The comb is exceedingly peculiar, being bright red in color, quite prominent, and in general appearance reminds one of the antlers of a deer; it inclines backward towards the crest, is triple in form, the outsides opening like the leaves of a book, while the centre has the appearance of an "ill-shaped strawberry," as Mr. Geyelin, the English writer, has expressed it.

The comb of the hen is quite small, and looks like coral. Her crest is also quite round and compact. The beak is dark horn-color; the eyes are white or pinkish white, mottled with lead color or black. This breed has the peculiar mark of the Dorking, having a fifth toe detached from the others, and slightly curving upward. The general carriage is upright and lively. The cut of these fowls representing birds bred by Mr. Charles Gammerdinger, Columbus, Ohio, is a good illustration of the breed.

Houdans never sit, consequently a few Cochins or Brahmas should be kept for incubating purposes. The little chicks usually hatch better and earlier than other breeds, nearly every egg proving fertile; they also mature early. They bear confinement well, but should be kept clean and free from dampness.

**Merits and Defects of Houdans.**—With respect to this subject we subjoin the following, from the pen of the well-known and extensive breeder of various kinds of poultry, Mr. W. H. Todd, of Vermillion, Ohio: "Of all the French breeds we have tried, embracing Crève Coeurs, La Flèche. and Houdans. we regard the latter as the hardiest and best, and, in real merit, they should rank high in comparison with any of the improved breeds, combining, as they do, very many excellent traits and advantages. Now thoroughly acclimated, Houdans are extremely hardy. early maturing, persistent layers, and one of the best table and market birds, the flesh being unusually white, juicy, and tender, with a large proportion of breast meat and less shrinkage in dressing than any other variety. Some claim that a Houdan will dress one-fifth more, ready for the kitchen, than any other fowl of the same live weight.

At maturity, cocks weigh seven to nine pounds, and hens six to seven, or more, when fattened. They are not termed 'high flyers,' and are contented almost anywhere, though in disposition lively and sprightly,—are not supposed to be very troublesome in gardens and orchards, and being good foragers, are well adapted to a free range, especially on the farm, where they are invariably well liked. They are virtually non-sitters, and, in order to breed them successfully, a few Brahma or Cochin hens should be kept to hatch and raise the chicks. Their eggs are generally fertile, and the chicks seldom die, except by accident. So rapid is their growth, that at two or three months old they rival the Brahmas, in weight, and are better developed for broilers and table use. Their thick crests and beards serve well as a protection from frost in winter. Admirers and breeders of Houdans are apt to take considerable pride and interest in them, which is not to be wondered at, as the beholder is always struck with their qnaint, comical appearance."

The chickens mature early, feather rapidly, are also quite hardy compared with many of our choice breeds, and are, as previously stated, becoming more so, as they become adapted to our climate. We can recommend them to the farmer as a profitable fowl generally.

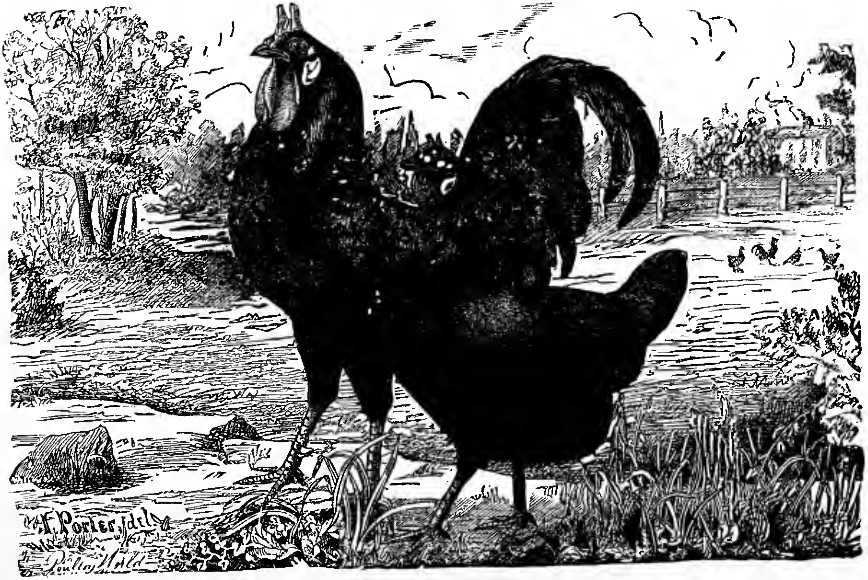
**Creve Coeurs.**—In conformation this breed resembles the Houdans, the principal difference being in the comb, which is a good size and consists of two horns in form, standing

nearly erect and brilliant red in color. The crest and beard are also heavier and fuller than those of the Houdan. The plumage is black with brilliant reflections, including the crest. The legs are a dark slate or black, and rather short. This breed is the oldest known in England of the French varieties, where it has been improved in general appearance, by breeders there, in producing a larger and fuller crest, than those of the imported fowls. They rarely sit, and are generally classed with the non-sitters. They are quiet and contented in disposition, and bear confinement well, and are tolerable good layers, though not equal to the Houdans. Their eggs are large and white. The chicks grow rapidly and mature early. Blue specimens of this breed are occasionally seen, also pure white, but the latter are very rare, and are probably mere "sports" from the Black, as all black fowls will occasionally produce white chickens, and the reverse, white fowls an occasional black chicken, which are freaks in which Dame Nature occasionally indulges.

**Merits and Defects of Creve Coeurs.**—Their principal merit is in their fine edible qualities, which, as we have previously stated, are considered by the French to be superior to their other breeds. The ease with which they are fattened, their early maturity, quiet disposition, and indifference with which they bear confinement, all tell in their favor, while the large size of their eggs is certainly an additional merit. They are not as abundant egg-producers as some fowls, though considered by many to be very good in this respect, and in our climate, are inclined to roup; but we believe it is the unanimous testimony of those having had experience in breeding them here, that they improve rapidly in these respects as they become acclimated, and we believe in a few years will be considered as hardy as any of our breeds of longer acquaintance. They are very valuable for crossing with other breeds, having a tendency to engraft their good qualities on inferior stock, the cross being almost without exception very hardy. However, as they are so large a fowl already, crossing with larger breeds would seem scarcely necessary for their improvement, yet where a farmer wishes to improve his stock that may be inferior to these, and does not object to a mixed breed, they are, as previously stated, very desirable.

**La Fleche.**—This breed resembles in general appearance the Spanish, having a red face, white ear lobes, and glossy black plumage. It is believed by many of our noted breeders and fanciers to have been derived in part from the Spanish breed. It is however much larger than that breed, the cocks often weighing nine and a half and ten pounds. It is long-bodied, long-legged, and rather gaunt-looking compared with the Houdans and Crève Coeurs, and has a very compact plumage. Its chief peculiarity in appearance is its comb, which is brilliant red and like two horns pointing upwards, giving the bird a very grotesque appearance. The wattles are also brilliant red, very pendulous and rounded; the ear lobes large and white. The beak is quite strong, and has in the cock a small knob of red flesh at its junction with the nostrils. It is dark in color, as also are the legs. This breed is being bred more extensively in this country at present than for a few years past, although it is still quite rare and the specimens seen at our exhibitions are few compared with some other breeds; in fact, we are surprised that the French birds are not disseminated more extensively in this country, since they possess so many excellent qualities.

**Merits and Defects of the La Fleche.**—The flesh of this fowl, like all the other French breeds, is of excellent quality, and in the opinion of Mr. Wright, to whom reference has frequently been made in this department of our work, is more delicate and juicy than that of any other breed of fowls, except the Game. It is highly valued in France, where it is very extensively produced, and always brings a high price in the market. The laying qualities of this breed are very good, the eggs being large and fine flavored. It does not however mature as early as the Houdans or Crève Coeurs, and is rather delicate in constitution, being exceedingly sensitive to cold or dampness, which inclines them, in our climate, to roup




LA FLÈCHE

and rheumatic afflictions. But as this fowl becomes better acclimated, and special pains are taken by breeders to breed only from mature, and perfectly healthy and vigorous birds, we believe this breed will yet become as hardy in our climate as in its own. New blood should be introduced often; breeds that are most rare being liable to be most seriously affected by in-and-in-breeding, owing to the great difficulty of procuring stock for this purpose that is unrelated.

**La Bresse.**—This breed, though common in France, is rarely imported to this country, as it seems to possess no distinguishing characteristics to tempt the fancier. Mr. Wright speaks of the La Bresse as "simply a fine, large, and delicate-fleshed race of barn-door or mongrel fowl, formed by judicious breeding," and also being of various colored plumage, though generally resembling the Dorking, of which it is probably a descendant.

**Merits and Defects of the La Bresse.**—The chief merit of this fowl has already been alluded to in the previous description, viz., its delicacy of flesh, which so distinguish the French breeds. Its size is always in its favor, and it is also a very fair egg-producer; but as it seems to possess the characteristics of a *mongrel* fowl, there can be no standard of judging them specified; hence their fine points, as a bird, are lacking to the fancier. It is stated by our best writers on poultry that those varieties of the breed approaching nearest the Dorking are the most valuable.

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## BREDAS OR GUELDERS.

THIS breed is somewhat peculiar in the form of its comb, it being rather a depression than a projection, which, with the exceedingly small tuft of feathers at the top of the head, — which can scarcely be called a crest,— gives the fowl a very singular appearance. With regard to the description of this breed, we take the following from "The Illustrated Book of Poultry," which is the very best authority on poultry matters of which we have any knowledge: "This cannot be called a fancy breed in any sense of the word, but is a good useful fowl nevertheless; and the only reason it has not been popular in England is, probably, that it is inferior in size to the Houdan, which in general qualities it much resembles. It is a fairly good layer, though not quite as good as the Houdan perhaps, and very hardy; rarely sits; has a round prominent breast, and is consequently a good table fowl. As an exhibition variety it is inferior, and only occasionally takes prizes in the 'Any Variety' class. The breed is *really* one, but of various colors; the name Guelders being applied to that of a cuckoo or Dominique marking, while another variety, all black, is termed Breda. White fowls are also, but rarely, seen, which are probably sports from the black, and are also called Bredas.

The general shape is Polish, but the crest, though just perceptible, is only so, being nearly absent; what there is of it is the same color of the body-feathers. The greatest peculiarity is however in the comb, which is absent altogether, only a depression in the red skin being visible, just over the cavernous nostrils, which thus become peculiarly conspicuous, and show, in spite of the deficient crest, the close resemblance to the Polish family. The shanks are (rather scantily) feathered, the birds being, in addition, vulture-hocked. In America, this breed is more extensively kept and widely known than in England, and we have some reason to think may have entered into the composition of some of Brother Jonathan's new creations. We can thoroughly recommend it as a good and useful fowl, but have not seen a good specimen for some years; in fact not since the dissolution of the National Poultry Company, with whose last manager the Cuckoo or Guelders variety was rather a favorite.

We cannot in this case even attempt a Scale of Points, since there is not a sufficiently definite opinion as to the characteristics to which the fowl should be bred. The legs should be dark or slaty-blue."

**Merits and Defects of the Bredas or Guelders.**—It is almost needless to add anything under this heading, since the peculiar merits and defects of this breed have already been given or hinted. As a table fowl, its flesh is very fine, being tender, delicate, and juicy. It is also very hardy, like the Houdans, which seem to be the exceptions in hardiness among French fowls in this country and England, and rarely sits; thus possessing the good quality of egg-production usually characteristic of non-sitters, while their eggs are of good size and rich in flavor. They are, however, smaller than the Houdans, which gives the latter the preference, and do not possess sufficient beauty of form, and color of plumage to make them favorites in that respect with the poultry fancier. As a useful and hardy fowl for the general farmer, both for the table and egg-production, they possess much merit, but for our own part, we prefer those breeds where these chief merits, with the minor ones, are found combined with beauty of plumage and graceful contour.

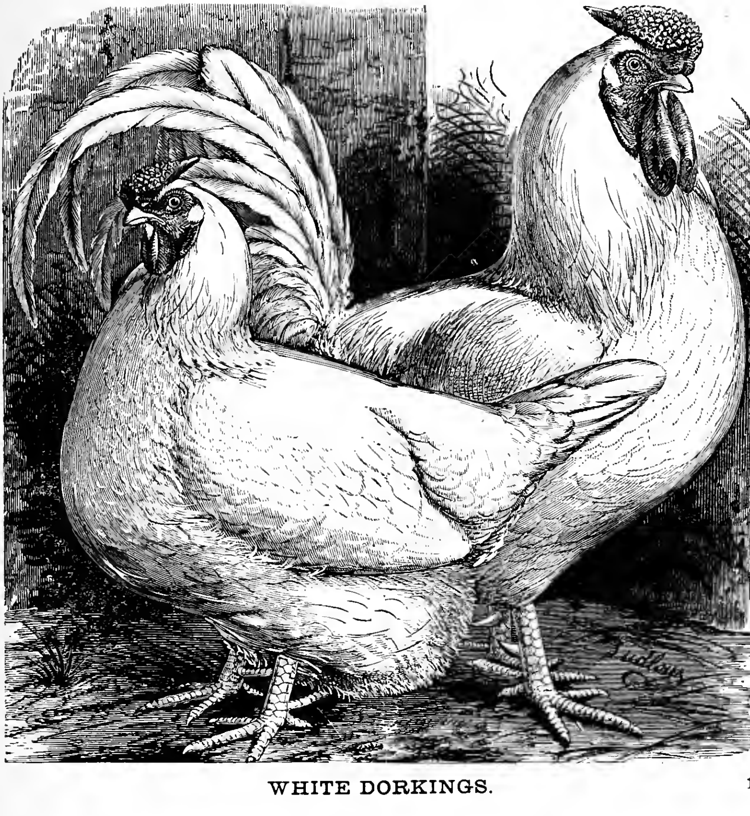
## DORKINGS.

THIS is not a new breed of fowls originated by some enterprising and enthusiastic fancier, but it is as old as the Roman Empire, its origin dating back through centuries. for we find them unmistakably described by Roman writers, in fact so definitely as to leave no doubt whatever that they were the one breed peculiarly and highly esteemed in that ancient Empire; and even to the present day they possess qualities and characteristics distinct from all others.

They are what would be termed at the present day preëminently an English breed of fowl, and are, as they always will be, a general favorite wherever known. The English regard them as superior to all other breeds as a table fowl, and it probably is unsurpassed by any and equaled by none, except, perhaps the Game; yet it has the advantage when compared with the latter, producing also a greater proportion of breast meat, being so very broad, deep, full-breasted, and plump in general contour. The average weight of the cock is from nine to ten pounds, though they occasionally turn the scales at eleven pounds and over; that of the hen from seven to eight pounds.

One peculiar mark of the Dorking is the fifth toe, which is placed above the fourth, distinct from the others, and curves slightly upward. The head is rather large, though not coarse,—beak stout and slightly curved; the comb of the colored varieties being either rose or single; the white variety always having the rose comb. The ear-lobes and wattles, like the comb, are bright red in color, the wattles being quite large and broad. The neck is large, of medium length, the back broad and long, the breast deep, broad, and full, the wings large, tail full, large, and well expanded, and legs of medium length, the whole appearance and general "make-up" of the fowl being compact and plump. The carriage is aristocratic and proud. They are quiet and docile in habits, and not extensive foragers, though they always thrive best with a good run, such as the liberty of a farm.

We are glad to know that this valuable breed of fowls is being more extensively bred in our country than formerly, and consequently its true merits, from experience and a thorough acquaintance, more fully understood and appreciated. The principal varieties of Dorkings are the Colored, Silver Grey, White, and Cuckoo, though the latter is less common with us than the English, being rarely seen in this country.



WHITE DORKINGS.

**Silver-Gray Dorkings.**—This variety of the Dorking family is a truly beautiful fowl, as will be seen from the following description by a noted English breeder, Mr. O. E. Cresswell, who has been very successful and has had extended experience in breeding them. "The chief distinctive exhibition points of Silver-Grays are as follows: The cock should have a pure silvery white neck-hackle, back, saddle-hackle, and upper wing-coverts; the black under-feathering of the back being entirely covered by the silvery white feathers of the neck, and the wing-coverts entirely free from chestnut patches. The tail, thighs, and breast, on the contrary, should be perfectly black. Perfection in the latter point is becoming very difficult of attainment, the extremely light shades now sought in the hen having, in my opinion, injuriously affected that great beauty in the cock,—a pure, glossy black breast.

After the second or third moult, the best cocks will show some grizzling on the thighs, but will not, on that account, breed any worse chickens. The hen should have body, back, and wings of a soft, silvery gray, perfectly free from red or reddish tinge; breast of a robin-red or salmon color; the neck-hackle as silvery as possible, with a fine distinct black stripe down the centre of the longer feathers. The most common faults in the hen are either distinctly reddish feathers in the wing or a slight brownish tinge all over the body. It may be observed that the latter of these faults seems to increase with age, while the former, on the contrary, decreases; and I have had birds very faulty in this respect as pullets, which, in the second moult, entirely lost the reddish feathers, and became perfectly silvery. The breast-color of the hen may vary from robin-red to pale salmon color; the latter is generally found with the most silvery general coloring; but I believe that the largest birds are almost always of the deeper color. The color of the Silver-gray Dorking hen, when anywhere near perfection, is of very great beauty. The light-gray ground is closely covered over by a minute penciling of darker gray, which gives that peculiar 'silvery' appearance so attractive, both in this case and that of the Duckwing Game hen."

The comb, ear-lobes, and wattles of this variety are bright red; the first may be either single or rose; when single it is large, upright, and evenly serrated. If it be a rose comb, it should be rather broad at the base, square in front, flat at the top, and covered with small projections or points, and terminate in a spike behind that is rather long and pointing slightly upward. The wing-coverts of the cock are a greenish-black, forming a wide bar across the wings; all the black feathers of the plumage having a beautiful gloss, with metallic or green reflections.

The tail is full, and in color a rich, greenish black, while the lesser tail-coverts have usually a narrow edging of white, giving a beautiful contrast with the black. The legs, with the highly-prized "fifth toe," that breeders are so careful to perpetuate, are flesh-color or white. The beak is also of the same color. The appearance of the hen is quite matronly, and they do, in fact, make the best of mothers when inclined to sit.

**Colored Dorkings.**—With regard to this variety we will say that in general characteristics, and all points except color of plumage, our previous description of Silver Gray Dorkings applies to this. We take the following with regard to them from the Standard of Excellence, which is what the judges at poultry shows abide by:

"Inasmuch as Colored Dorkings are of diverse colors or shadings, any of which are recognized, no extended or critical description of the colors of these will be attempted. It will be sufficient to say that the general characteristics of Colored and Silver-gray Dorkings are the same; the chief, if not the only difference between them, being in the *color* of their plumage. The numerical value of the "points" of Colored and other Dorkings is the same: when, therefore, Colored birds are shown, the first pre-requisite will be that they *match* in the color of their plumage and other points."

We are unable to give a definite description, owing to the variety of colors and shades recognized. The darker plumaged birds are, however, considered the most beautiful and

desirable of the colored variety, notwithstanding the latitude given by the Standard in this respect. They probably have more admirers than any other of the Dorking family, though all varieties are very attractive in plumage and general appearance. Mr. V. A. Blakeslee, of Winsted, Conn., who has for several years been a well known and successful breeder of this variety, says of them: "The average weight of the Colored Dorkings, as I find them, is cocks, 9 to 10 lbs.; hens, 6½ to 8 lbs.; although I have seen pullets from stock that is now in my yard weigh 8 lbs. at Christmas. I do not find them inclined to sit early enough to raise early chickens, and I have always purchased common hens to do my sitting; and in fact they are not to be classed as bad sitters. They are the best of mothers, and I will here say I have a hen in my yards that is three years old and has never offered to sit. I also find that at the age of even six and seven years they lay nearly as well as when two years old. Many write me: 'Are they hardy?' I answer yes, if you have a run for them, or put them on a farm; and no fowl will do better. Many have an idea that they are subject to roup. So is any fowl that is not properly cared for. In nine years I have not lost five fowls with the roup.

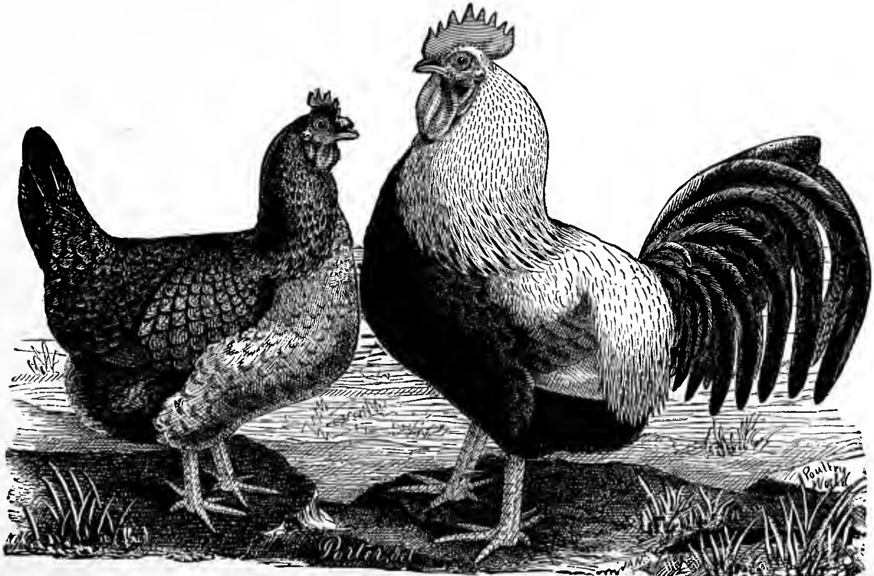
They will not do well in low, damp, confined quarters. Give them a run and high ground, and they will mature quickly and have more flesh with finer bone than any other known variety in the same time. In breeding early market poultry, a cross of the Dorking and Buff Cochin makes one of the best layers in winter that can be had. I find Dorkings good layers, though not as prolific in winter months as the Asiatics, but in the spring, from February to the next September, I will not except even the Leghorns; for I believe they will lay more eggs than any other variety of poultry, and, understand me, they will *lay well in winter*, if well kept. Pullets, with me, commence laying at about seven months old."

It is generally conceded by most poultry breeders that while the Dorkings may be called fair layers, with good care, yet they are inferior in the egg-producing quality to most of our standard breeds, taking the year through, though of course the *care* they receive makes a great difference in this respect, the same as with any breed of fowls. For a hen to be a *perpetual egg manufacturer*, she must be supplied with food material, and conditions suited to the article to be manufactured.

**White Dorkings.**—In symmetry this variety is said to surpass all others of the Dorking breed; its outlines and general contour being very graceful, while its beautiful pure white plumage, set off by the brilliant coral red of the comb and wattles, presents a scene that cannot fail to command admiration, even from the most practical and prosaic, who never see in a fowl anything but a manufactory of meat and eggs. This variety has doubtless more pure Dorking blood in it than any of the others, since for years it was the only variety that produced invariably the fifth toe, although now the others have been improved to the extent that they seldom fail to breed that peculiarity, so dear to the heart of the bird fancier. Pure white plumaged fowls are always attractive on a green lawn, and when given a large run, they are kept clean and healthy.

The White Dorkings are not quite as large as the colored varieties, but we see no reason why, with a little judicious breeding,—taking care to select the *largest*, and *only mature* birds (perhaps two years of age) for breeding purposes, or by crossing with the larger varieties. these may not be bred as large or even larger than their, at present, larger relatives. They are very gentle, easily tamed, and will feed from the hand with the utmost confidence, where gently treated. They are said to be better layers than the Colored Dorkings, their eggs peculiarly delicate, the shell being of a pinky or French white shade; they are also of large size. They, like all the Dorking varieties, require a dry soil and large range. If confined, their plumage becomes soiled and dingy, and the birds never seem in such cases to be healthy.

The great difficulty of breeding this variety—a difficulty with all pure white-plumaged




COLORED DORKINGS.
Bred by Mr. John K. Camp, Winsted, Conn.

1345

fowls—is the tendency of yellow tinge to the plumage, especially in the cock; therefore it is desirable to breed always from those birds having the richest and clearest white plumage, and provide them with shade during the summer, to which they can have access. In general characteristics the description already given of the Dorking breed applies to the White variety. The plumage throughout should be a clear pure white; the comb should be rose, and set firmly on the head, standing erect, square in front, the top flat and evenly covered with small points or projections, and terminating in a spike behind that should be long and nearly straight, pointing slightly upward. The legs should be white or pinkish white, and the fifth toe well defined, separate from the others, and slightly curving upward. The eyes are full and bright, and the carriage quite stately and aristocratic. Mr. J. Y. Bicknell, of Buffalo, N. Y., a cut of whose fowls illustrates this breed, says of them:

"As a matter of taste, and as a characteristic of the Dorking family, I regard the fifth toe as very important. The cut does not represent it to my liking. It should not only be distinct from the others, but should curve regularly upwards. The Standard requires rose combs for White Dorkings and single combs for others. Single combs should be even, straight, of medium size, and free from side sprigs. Standard rose combs are square in front, tapering back, even on top, free from hollows, with a true, *single* spike behind. In selecting breeding stock be careful about good combs and toes, for they are quite apt to be faulty. Never breed from a bird with short, straight, fifth toe, having the appearance of being glued to the fourth. The popular idea that five-toed fowls are more subject to bumble-foot than others is all nonsense. The fifth toe is entirely out of the way of corns, bunions, or the tumors that characterize bumble-foot. Such tumors are always on the bottom of the feet, and are as common to Spanish, Games, Hamburgs, and other four-toed birds as to Dorkings. As to hardiness, they may be classed with Hamburgs and most of the smaller varieties, yet they are not so hardy as Javas, Asiatics, or Plymouth Rocks. They will not bear too much crowding, and when roup gets among them it proves very fatal."

**Cuckoo Dorkings.**—This branch of the Dorking family has the peculiar plumage called in England "Cuckoo color," but in America "Dominique." It consists of a marking of bars or pencilings of dark blue-gray on a ground of lighter gray, similar to the breast of the cuckoo, though the color and shades may vary considerably, the ground-color sometimes varying from nearly white to a bluish-gray, and the pencilings from a bluish-gray to nearly black. They are larger than the white variety, and slightly smaller than the colored: but are fair layers and the most hardy of the Dorking breed, which latter quality renders it best adapted of all this breed for general farm use. The marking of plumage, as above described, should be uniform throughout the body; the comb may be either single or rose, and, like all the other varieties, a bright coral red The chief obstacles in breeding these fowls for show is the occurrence of an occasional reddish yellow, or black feather in the plumage, while, to be a perfect specimen, the cuckoo color should be uniform throughout. Although comparatively but little is known, this variety possesses merits that would make it a valuable fowl.

**Merits and Defects of the Dorkings.**—As a table fowl, the Dorking stands unsurpassed, being peculiarly delicate in flavor, tender, and juicy, with an abundance of breast meat. Their large size, early maturity, and rapid growth, also tell much in their favor, while their beauty of form and plumage are not the least of their merits. Gentle in disposition, they make the best of pets, and seem to enjoy being petted, almost as much as a cat does, being fully equal to the Brahma in this respect. For this reason alone, we could commend them to ladies as being suited especially to their care. They make the best of mothers also, never leaving their chickens until they are old enough to take care of themselves in a measure, and are in this respect better than even the Cochins and Brahmas, as they remain longer with their broods than most other breeds. They are however only fair in egg-

production, though with good care, suitable food, plenty of pure water, and sufficient warmth, they improve greatly in this respect. The eggs are large and round, and nearly equal in size at both ends. They will also improve in general hardiness, by long continued and judicious training for this purpose. Much can be accomplished in this respect, by not hatching the chicks too early, as they are peculiarly sensitive to the wet and cold. For our changeable climate, the middle of April or first of May is sufficiently early, and we have always noticed that the late chicks of this breed with this arrangement and favorable temperature, fully equal in size, at the age of three or four months, those earlier hatched.

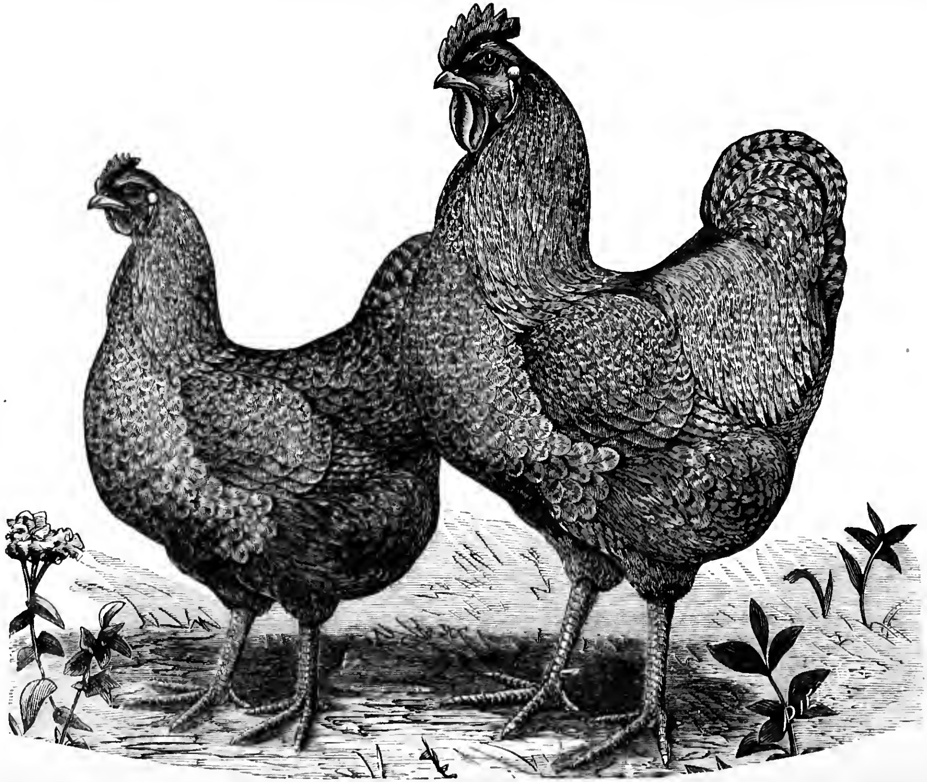
The Dorking breed, of whatever variety, should always have a dry soil, otherwise they will not thrive well. Many breeders put iron or other simple tonic in the water to ward off the gapes and roup, as in this case, as all others, the old adage proves true that "an ounce of of prevention is worth a pound of cure," for when these diseases once make their appearance among a Dorking flock they are very difficult to turn out again. All fowls in the least affected by either should be at once separated from the others until entirely cured. This breed is also subject to a disease called the "bumble foot," in fact, more liable to it than any other breed of which we are familiar. It does not bear confinement well, and when chickens are thus hatched, they are very apt to be delicate for the first two or three weeks, though fairly hardy afterwards. Confinement and wet soil are their bane, and the only successful means of keeping them under such circumstances, is to pay strict attention to cleanliness and drainage, and to give them fresh turf every day with vegetable food. Prize Dorkings have thus often been reared in graveled yards not exceeding three hundred square feet.

We would not, however, recommend it as a profitable fowl to keep, except with an extensive range. This breed, as we have previously stated, is very valuable to cross with others, the most successful and common being a cross with the Brahmas and Cochins; the Game is also used for this purpose, but not, however, with very great advantage, since it diminishes both the size and squareness of form without gaining very perceptibly in hardiness. A cross is sometimes made with the Houdan cock, but the plumage varies greatly, though the chickens are very hardy, and when matured lay very well, and the flesh is excellent. In laying qualities, the cross thus produced excel the Dorkings.

## DOMINIQUES.

THE Dominique is one of the oldest of the American breeds, and resembles much the Cuckoo Dorking, also the Scotch Grays, previously described. In form, it resembles the Dorking; is of medium size, cocks averaging between seven and eight pounds, and hens six pounds. The plumage of the body, and even the feathers of the tail are a light slaty-blue penciled across with bars of a darker blue; the shading, however, varies, the penciling in some cases being very dark, or nearly black; the medium color is preferred. Whether the color be light or dark, the hackle and saddle feathers of the cock should be of a corresponding shade, any white, reddish, or golden feathers being considered a great defect; this objection can be avoided by careful breeding, choosing only the most perfect specimens for this purpose.

This description of plumage, which resembles the breast of the Cuckoo, will apply to a large class of poultry, many of which have been previously described. The Cuckoo Dorkings, Cuckoo Cochins, Anconas or Cuckoo Spanish, Cuckoo Polish, Guelders or Cuckoo Bredas, and Scotch Grays, all have this peculiar plumage, which is distinguished from the Penciled Hamburgs, which it closely resembles in marking, in the fact of the bars or penciling being



PLYMOUTH ROCKS.
Owned and bred by C. A. Keefer, Sterling, Ill.

larger and coarser, and more particularly in the penciling being shaded gradually dark into light, instead of the distinct and sharp contrast between the penciling and ground color that characterizes the Penciled Hamburgs. The eyes are large and bright; wattles broad and full. and are bright red, as are also the ear lobes. The beak and legs are bright yellow. The hen is marked similarly to the cock in plumage, and together in their plain "homespun" looking suit, although not beautiful, they are very suitable for many localities where a more showy bird would look almost out of place.

They are also desirable in plumage, in localities where the soot or smoke would soil the feathers of a light or white plumaged bird. The carriage is upright and rather sprightly. In breeding this variety, it is well to select a medium shade, or such as would be desired in the chickens, in the plumage of the hen. The cock should be of a slightly darker shade (since they are apt to breed a little lighter), carefully selecting those in both sexes free from either red, black, or golden feathers in the hackle or elsewhere; by this means they may be bred true to color and of a desirable shade.

**Merits and Defects of Dominiques.**—Dominiques are hardy and consequently bred with comparative ease; they are also superior table fowls, though not, of course, equal to the Dorking in this respect, though they are superior to the Dorking in laying qualities, and also the Scotch Greys, which they closely resemble in plumage. They make excellent mothers, mature early, grow rapidly, and are a generally useful fowl. We can freely recommend them as such, though they will probably never be a very popular breed for showing, not being very attractive in general appearance. They are excellent foragers. The cocks average from seven to eight pounds, and the hens about six pounds.

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## PLYMOUTH ROCKS.

THE Plymouth Rock is preëminently an American fowl. It is of New England origin, and supposed to have been produced by a cross between the Black Java or Cochin, and the Dominique variety. It has now become a well established and popular breed, and proves a very desirable and valuable acquisition to our American-bred varieties. It is the general experience of those who breed Plymouth Rocks, that mating birds that have a dark plumage in both sexes, produces a progeny too dark, with an indistinct marking, and a tendency to dark colored legs and beak, instead of the bright yellow so much preferred by American fanciers. This is especially true of the pullets, and can only be remedied by selecting a light-colored cock with the dark-colored hens, or having both the cock and hens nearly matching in color, and of the shade desired in the chickens, though the former is considered by most breeders to be the most desirable method. The average weight of the cock is about ten pounds and that of the hen eight pounds.

The plumage is Dominique, that is, of a bluish gray, with each feather penciled across with dark blue bars, the darkest specimens having the bars nearly black, yet the marking in either dark or light shades, should be distinct and free from a clouded or blended appearance. The medium shade is considered the most desirable color. Any mixture of other colors, such as white, black, and red feathers (as is sometimes the case), is considered a great defect, and such birds should be excluded from the breeding pens. They are symmetrical in form, have a plump body with well rounded breast and broad back, having in all the appearance of compactness and solidity. The head is of medium size, and somewhat resembles the Cochin. The beak is yellow in color, short, stout at the base, and well curved at the end. The comb is of medium size, single, upright, and evenly serrated; ear lobes and wattles bright red, and

of medium size, and fine texture. The neck is rather short, or perhaps we should say, medium, and well arched, with a very full hackle, giving great width at the shoulders.

The wings are of medium size; the tail rather small, but larger than that of the Cochin, and carried nearly upright. The legs are of medium length, and bright yellow, and the carriage of the cock upright and commanding. The hen is marked similarly to the cock, but seems, if anything, more compact and plump in body than the cock. Her manner is quite matronly. There was formerly considerable difficulty experienced in breeding the Plymouth Rock true to color, but time and patience, with judicious care in selection, have corrected this evil, and they now breed very true in this respect.

**Merits and Defects of Plymouth Rocks.**—They are superior table fowls, large bodied and plump; they also grow rapidly and mature early, making good broilers for the early spring market, while their superior laying qualities are too well known to necessitate comment in that respect. Their extreme hardiness is also a strong argument in their favor. We give the following respecting this breed, from the well known poultry breeder, W. H. Todd, of Vermillion, Ohio: "The longer we keep them, the better we like them, and, of all breeds, we think Plymouth Rocks *the fowl* for the farmer, and for general purposes. They combine more in themselves than any variety we know of. Are so hardy and healthy that they seem proof against the diseases that annually carry off so many fine birds. The chicks are lively and strong, and mature very rapidly, becoming large, and early fit for market. Their flesh, in quality, is fine grained, tender, and juicy, and, as dressed poultry, they are plump, full-breasted, and with fine, yellow skin and legs, look well and sell well in market. They can be depended on for eggs nearly *all the year round*, as well as for sitters and mothers, in season. Are not high flyers, and are excellent foragers, when given their liberty." The plumage of these birds is not as attractive as that of many breeds, it being really homely and grave in color, but their really economic and valuable qualities as egg-producers, and as a table fowl, place them in the front rank as a fowl for general purposes on the farm.

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## ANDALUSIANS.

THIS breed is a native of the province of Andalusia in Spain, and was formerly classed with the Spanish varieties, but is now considered to be a distinct breed. It is larger and more hardy than the other Spanish varieties, and unlike them also, the young chickens feather rapidly and easily, which adds much to their chances of life against storms and cold, and gives them the advantage in this respect. They are a very useful fowl, producing eggs abundantly, and are very desirable as a table fowl also. The comb is similar to the other Spanish varieties; also general contour of body. The plumage is quite attractive, being a kind of dove color or bluish gray, approaching a black on the back, and quite glossy. The neck-hackle is dark slate, and sometimes nearly black in color; the tail bluish gray; the beak and legs are also of a dark blue tinge, approaching a slate color. Sometimes the plumage is penciled slightly with a darker hue or black, which adds much to the beauty of the bird. They have become more generally known, within a few years past, and also more popular. The plumage of the hen is similar to that of the cock, except of a slightly lighter shade. The cock usually weighs about seven pounds, the hens from five to six pounds each. They are more precocious than the Spanish breeds, and also rather pugnacious, but not sufficiently gamey in disposition to be troublesome. The hens have been known to sit, but this is very rare among them. They are classed with the non-sitters.

**Merits and Defects of Andalusians.**—They are, as we have already stated, very prolific as egg-producers, having frequently been known to lay from 200 to 225 eggs in a year, which is certainly a *very good* egg record for any breed of hens. They are also very hardy, feather easily and rapidly, and mature early, young cocks often crowing at six or seven weeks of age, presenting a most ludicrous and amusing appearance. The flesh is of fine flavor, tender, and juicy; they are also plump-bodied and easily fattened, and do not consume as much food as some breeds of their size. They do not breed as true to color generally, however, as the Spanish breeds.

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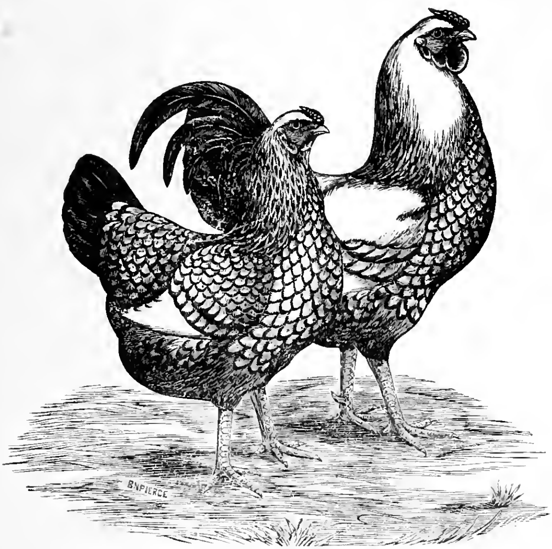
## AMERICAN SEBRIGHTS.

THIS, as the name indicates, is an American breed of fowls, being one of the late breeds, and having been but little known until a comparatively recent date. They are at present, however, becoming quite common, and highly appreciated, combining as they do many excellent qualities, both as a table fowl and for egg production.



AMERICAN SEBRIGHTS OR WYANDOTTES.
Owned by B. D. Maycumber, Truxton, N. Y.

Both single and rose-comb fowls are to be found of this breed, also those with smooth and feathered legs; but those are generally preferred with a low rose comb, and unfeathered legs. The ear lobes are bright red. When matured the cocks will average nine pounds, and the hens about seven pounds. They are plump-bodied, with a prominent breast, the body being broad and deep, resembling in shape that of the Dorking; plumage black, even and heavily laced with white; tail solid black; the legs rather short, and bright yellow.

**Merits and Defects of American Sebrights.**—These fowls mature early, and the chicks are quite hardy. They also fatten readily, and the flesh is of very good quality. They are excellent layers when well cared for, but like many other breeds will thrive best when allowed considerable range, although they bear confinement well. They are contented in disposition, and will not attempt to fly over a fence four feet high. They make good mothers when allowed to sit. They do not, however, breed quite as true to feather as some of the older and long-established breeds, but are improving in this respect in the hands of intelligent breeders. As a fowl for the table and egg-production, they cannot fail of giving good satisfaction, when properly cared for.

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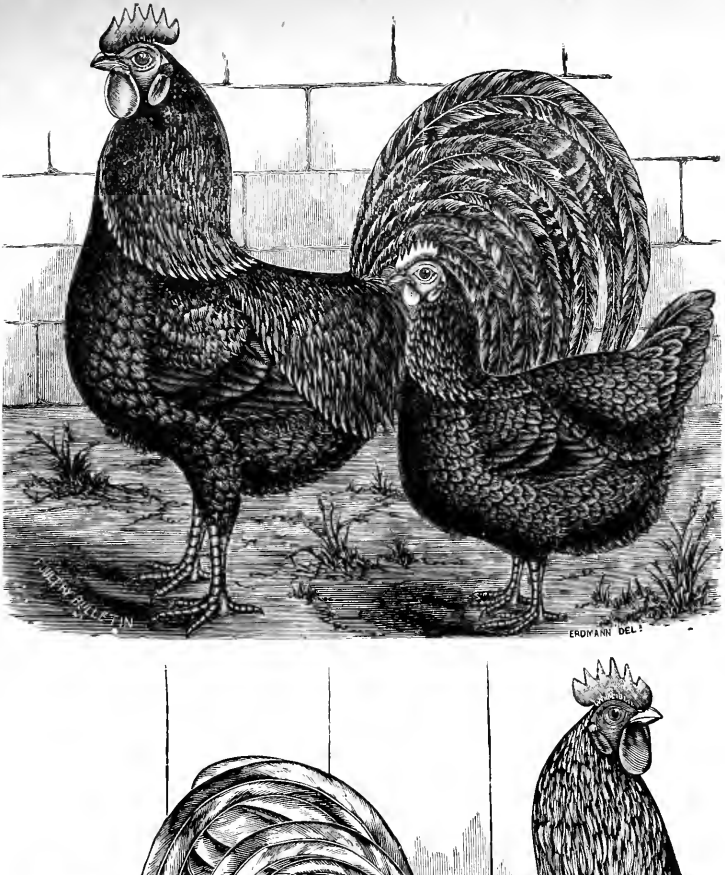
## BLACK JAVAS.

THE origin, description, etc., of the varieties of the Java breed represented in this country were prepared for this work by Mr. J. G. Bicknell, so well known as a poultry fancier, and an extensive poultry breeder. The origin of the Black Javas is as follows: "About thirty years since a family living in Missouri came in possession of three eggs, from the yard of a celebrated doctor who delighted in the ownership of a few fine fowls called Javas. The doctor would neither sell the progeny nor consent to having it grace the yards of his neighbors, but his coachman 'borrowed' the three eggs above named, and from them the American Javas have all descended. They were first brought into Dutchess County, N. Y., about twenty five years ago, by a family removing thence from Missouri, and about fifteen years since by the same family into Orleans County, N. Y., where they have been bred in large numbers ever since. In all this time no fresh blood has been introduced, all crossings having been obtained by different matings of the same family.

Right here let us remember that most fowls are made of crosses, and when one type is decided upon, we must keep clear of foreign blood in order to retain that type, and all crossing, whether by one or more breeders, must be from the original stock. That is just what has been done with Black Javas, and their activity and manifest vitality strikes us forcibly at first sight. Until three or four years since they have been bred in comparative obscurity—yet in their immediate vicinity they have been noted for their large size, quick maturity, hardiness, and beauty. The color is a rich lustrous black, with that beautiful green shading so desirable; comb single; shanks black, approaching willow, free from feathers. The bottoms of the feet are always yellow, corresponding with the color of the skin. When served on the table the flesh does not present that objectionable dark color common to Spanish and some other breeds, but is equal to the Plymouth Rock in every particular.

At the outset let it be understood that Javas are not of foreign origin, but are an American fowl and deserve an American name, still the name has nothing to do with their merits or demerits. Modern Javas bear no relation to the Plymouth Rock. The Java side of the latter was in reality a Black Cochin, and merged into the Cochin class where it properly belongs. Among those who are acquainted with them, I find the most universal belief is that they are like the Javas of ten years ago—more Cochin than anything else. Let us not confound the so-called Javas of 'ye olden time' with those of the present day. They are entirely unlike Cochin in shape and style, and in almost every particular. Our American Javas have characteristics of their own, differing from any other known breed, clearly demonstrating the fact that they are indebted to no other recognized variety for their existence. They present large size, long bodies, and deep, full breast—just what is required for usefulness, hardiness, and superior table qualities.




BLACK AND MOTTLED JAVAS.
Owned by J. G. Bicknell, Buffalo, N. Y.

In breeding them, care has been exercised in selecting birds of certain shape and a good degree of vigor, hence their vitality and activity are rarely equaled and never surpassed by fowls of equal size. Notwithstanding these facts no high fence is needed to keep Javas within bounds. In my long experience with nearly everything in the line of domestic fowls, I have never found a breed better adapted to close quarters, nor one that could resist the attacks of disease in every form with more fortitude. I have never lost one with any disease. Occasionally I have seen one attacked with roup, consequent upon exposure while attending shows, and in every case, some of which were severe, a few days time and simple remedies effected a permanent cure. When we consider this, and the fact that they have been bred in for twenty years, we cannot fail to credit them with sterling worth.

In selecting breeding stock, be sure to select birds with straight combs, brilliant black plumage, black shanks, and dark colored eyes. Willow shanks are tolerated, but are objectionable in young Javas. In old male birds, however, we can seldom avoid them. *Never breed from red feathers.* Better allow a little white than red. The standard calls for 'brilliant red' comb, which is correct for male birds, but some of the striking characteristics of the breed are *black* comb, face, and wattles among females. Pullets should *always* have them, and if retained at maturity so much the better. I now have a few hens two years old with comb, face, and wattles nearly black. Kill all birds that show striking defects, and retain only first-class ones for breeding purposes. When first hatched, and until they moult their first feathers, Javas will show very much white, but when matured every white feather should disappear.

**Mottled Javas.**—This valuable acquisition to our poultry department was originated ten years since by crossing a large white hen with a Black Java cock. The hen was selected from a flock of large white fowls highly prized for their superior laying and table qualities. They had been bred pure for many years, but were unlike anything described in the Standard. The first cross, although not intended for the purpose of forming a new breed, developed qualities worthy of cultivation. In crossing for new breeds it is highly important that both parents are from established strains; otherwise we have so many types to contend with that the results are entirely uncertain.

Although accidental, the cross that produced this new variety was in harmony with this principle, and now we find them breeding with as much uniformity as many of our old established breeds. In color they are black and white, closely resembling Houdans in this particular, but in no other. The color should be broken, black and white throughout, not a large patch of black followed by patches of white, but both evenly distributed. If either predominates it should be the former; yet we find, as with Houdans, some will be too light and some too dark in color. Although they are called 'mottled,' they are more properly *splashed*, but the term 'Splashed Java' would not sound quite as euphonious as the name chosen. Their history, after describing Black Javas, must necessarily be short, for the general characteristics of each are very nearly alike, yet I think the fresh blood introduced by the white hen has a tendency to give the mottles an advantage over the others in laying qualities; at least I have found it so with my stock. As they have descended from parents with yellow shanks on one side and black on the other, I find both colors are common, yet neither disqualifies. The shanks should be yellow, blotched with black; but even when black alone appears the bottoms of the feet are always yellow.

In selecting stock, utility first, and then beauty, should be the rule. The former in domestic fowls consists in hardiness, early maturity, and large size, with good laying and table qualities. Almost any variety possesses one or more of these qualities, but a combination of all, with beauty added, can hardly be expected. No domestic fowl, according to our opinion, approaches nearer to this high standard than a flock of *well-selected* mottled Javas. They are certainly attractive, and at first sight impress us with their proud and noble appear-

ance. Like a valuable animal of any kind, they denote a capacity for *business*, and that is just what they possess.

The breeding stock should be selected with a view to large size, uniformity in markings, small combs, and, if possible, with yellow shanks blotched with black. They, like the Black variety, were bred very carelessly regarding fine points by those who accidentally produced the original stock; but careful breeders are now improving them from year to year, and even now the uniformity of markings is equal to that of the Houdan, which has been bred so many years.

In order to breed any stock satisfactorily, certain rules must be understood and followed. Some may have raised superior specimens, regardless of all rules, by the force of qualities already inbred, but improvements cannot be expected unless great care is observed in crossing and mating. Fowls with superior qualities already inbred will continue to reproduce good specimens with far less trouble than was required to bring them to that desired point; still they will deteriorate rapidly unless great care is exercised in the selection for breeding purposes.

**Merits and Defects of Javas.**—In our opinion, no fowls are better calculated to adapt themselves to the wants of him who desires, in his poultry, an automatic machine that will manufacture eggs and chickens unaided and uncared for, yet I hope they may never fall into such unworthy hands. They are certainly adapted to the farmer who gives his fowls free range and good quarters, one who desires large profit in eggs and flesh. No better choice can be made by him who has only a small yard and likes a combination of beauty and utility, and who does not want a kind that is always in his neighbor's yard.

I have bred Plymouth Rocks for ten years, and in points of utility have considered them fully equal to any other recognized variety. I still value them, in this respect, as highly as ever, but the great trouble with them is that they breed too many imperfections. In order to get two or three pairs of exhibition birds we must breed a score or more chicks. Javas possess all the good qualities of Plymouth Rocks, without so many defects. From a flock of fifty or more, there will be only a small per cent. of culls, instead of a small per cent. of good birds. Java hens are good breeders and rear their chicks well, yet are far less persistent in sitting than Asiatics. They are good summer and winter layers, and the chicks are ready for broilers at an early age.

In all kinds of thoroughbred stock we have an acknowledged standard, a certain established type representing every point in perfection. Some of these points may be so thoroughly established that little or no care is required to retain them, while others are seldom reached. The type for Black Javas is,—body long and broad; breast deep and full; comb single, straight, and of medium size; eyes brown, the darker the better; shanks black, or black approaching willow; plumage rich, lustrous black throughout.

Every experienced breeder knows that all stock has what may be termed common defects, faults that often manifest themselves. It is with these that we have to contend in breeding for fine points, hence the necessity of thoroughly understanding them. Among the common faults of all black fowls, are occasional white or red feathers. Javas are not exempt from these faults, and, in addition, crooked combs and light colored eyes often annoy us."

# MALAYS.

IN describing this breed, we give the following from Wright's Practical Poultry Keeper: "The Malay was the first introduced of the gigantic Asiatic breeds, and in stature exceeds that of any yet known. The cock weighs or should weigh from nine to eleven pounds, and when fully grown should stand *at least* two feet six inches high. But the general size of this breed has of late greatly deteriorated. In form and make, Malays are as different from Cochins as can well be. They are exceedingly long in the neck and legs, and the carriage is so upright that the back forms a steep incline. The wings are carried high, and project very much at the shoulders. Towards the tail, on the contrary, the body becomes narrow—the conformation being thus exactly opposite to that of the Shanghai. The tail is small, and that of the cock droops.

The plumage is very close, firm, and glossy, more so than that of any other breed, and giving to the bird a peculiar lustre when viewed in the light. The colors vary much. We consider pure white the most beautiful of all; but the most usual is that well known under the title of brown-breasted red game. The legs are yellow, but quite naked. The head and beak are long, the latter being rather hooked; comb low and flat, covered with small prominences like warts; wattles and deaf-ears very small; eyes usually yellow. The whole face and a great part of the throat are red and naked, and the whole expression 'snaky' and cruel. This is not belied by the real character of the breed, which is most ferocious, even more so than Game fowls, though inferior to the latter in real courage.

Malays are subject to an evil habit of eating each other's feathers, a propensity which often occurs in close confinement, and can only be cured by turning them on to a grass run of tolerable extent, and giving plenty of lettuce, with an occasional purgative. The chickens are delicate, but the adult birds are hardy enough. They appear especially adapted to courts and alleys, and may not unfrequently be seen in such localities in London."

The colors of the Malay fowl are White, Black, and Piles, the most common being a resemblance to the Black-red Game. In the East Indies they are often used for the pit, and are very ferocious, as has been previously noted. It is a well known fact that many varieties of the Game contain more or less of the Malay blood.

**Merits and Defects of Malays.**— "The principal merit of Malays is as table fowls. Skinny as they appear, the breast, wings, and merrythought together carry more meat than perhaps any other breed; and, when under a year old, of very good quality and flavor. They also make good crosses with several breeds. Mated with the Dorking they produce splendid fowls for the table, which also lay well; and with the Spanish, though both parents are long-legged, the result is most usually a short-legged bird of *peculiar* beauty in the plumage, good for the table, and, if a hen, a remarkably good sitter and mother. They have also been extensively crossed with the English Game fowl, in order to increase the strength, size, ferocity, and hardness of feather."

They bear confinement well, and their plumage is peculiarly lustrous; the hens, however, are poor layers, and their quarrelsome disposition makes them quite troublesome. It is said that a cross with the Spanish will often produce fine, large birds of black plumage, and excellent layers, as well as table fowl. Malays are often used as crosses with breeds having a deficiency of size in wings and breast, to aid in improving this deficiency; but when crossed with the Cochin, singular as it may seem, the result is said to be worse than the original. The Malay is not generally a favorite with fanciers, and will probably never be very extensively bred, either in this country or Europe.

## RUSSIANS.

THIS breed was formerly extensively reared in Scotland, and quite common in some parts of England, but is now quite rare. In this country they are occasionally seen, though they are mostly of the black plumaged variety. The head is of medium size; the comb generally rose, though sometimes single. The eyes are full and bright, and the beak short, stout, and curved; its color dark horn. They have a full, heavy beard, but no crest. The body is round and compact, back broad, tapering towards the tail; breast round and prominent. The tail is devoid of long sickle feathers, so common in the cock, and is of medium size, and carried rather upright. The legs are a dark lead in color, though often of a yellowish tinge. The plumage is a greenish-black throughout, and glossy. The skin is quite yellow.

**Merits and Defects of Russians.**—This breed is quite hardy, and consequently easily reared. The hens are good layers, though the eggs are rather small. They also make good incubators and mothers. As a breed, they are small eaters, and therefore an economic fowl to keep in this respect. They are also a very good table fowl. The chicks mature early, grow rapidly, and breed quite true to feather.

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## SULTANS.

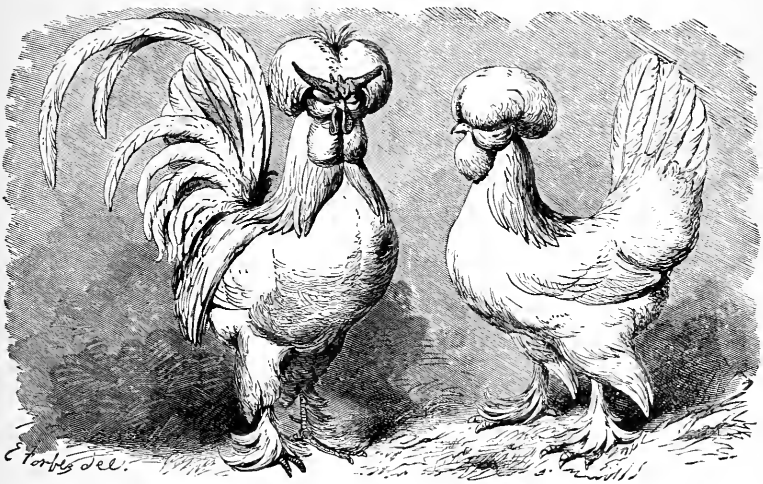
THESE pretty birds were first introduced into England in 1854, by Miss Watts of Hampstead, having been sent her by a friend living in Constantinople. They were there called "Serai-Täook," which translated is "Sultan's fowls," or "fowls of the Sultan," hence the English called them Sultans. They are considered by many to be the most beautiful of all domestic fowls, while their gentle, docile disposition cannot fail to gain the admiration and interest of those having charge of them. Like the Polish, which they much resemble in many respects, they are fond of being petted, and are in habits happy-tempered, brisk, sprightly, and tame, resembling in the latter respect Bantams. The average weight of the cock is from four to five pounds, that of the hen about three and a half pounds.

We insert the following description as given by Miss Watts: "They rather resemble our White Polands, but with more abundant feathering, and shorter legs, which are vulture-hocked, and feathered to the toes. In general habits, they are brisk and happy-tempered; but not kept in as easily as Cochins. They are very good layers; their eggs large and white; they are non-sitters, and small eaters. A grass-run with them will remain green long after the crop would have been cleared by either Brahmas or Cochins; and with scattered food they soon become satisfied, and walk away. They are the size of the English Poland fowl. Their plumage is white and flowing; they have a full-sized, compact Poland tuft on the head, are muffed, have a good flowing tail, short, well-feathered legs, and five toes on each foot. The comb is merely two little points, and the wattles are very small. We have never seen fowls more fully decorated,—full tail, abundant furnishing in hackle, almost touching the ground, boots, vulture-hocks, beard, whiskers, and full round Polish crest. They are pure white, and so beautiful that it is to be hoped that amateurs will procure fresh importations before they disappear from among existing kinds."

Such was the description of these little fowls when first imported into England so many years since, and which describes them so well to-day, showing that they have been bred with care. The beard is close around the throat, crosses the face and joins the crest, which is quite

large and full, and differs from that of the Polish by being more erect and not hiding the eyes. The beak resembles that of the Polish breeds, with large open nostrils. The neck is rather short, arched, and carried well back, and is furnished with a heavy and abundant hackle. The back is broad and slopes a little towards the tail. The body is square and deep, with a full prominent breast. The wings are somewhat large and low, which, with the vulture-hocks and short legs, give the body rather of a low carriage. The tail is very full, and furnished with beautiful long sickle feathers, and abundant tail coverts. The legs are dark blue in color, and very heavily feathered, even to the ends of the toes.

**Merits and Defects of Sultans.** — They are good layers, and easily reared, being quite hardy when matured, though some breeders regard them as rather delicate when chickens. They are non-sitters, and their quaint little ways make them quite fascinating as



SULTANS.

pets, while their beauty of form and plumage renders them highly ornamental to any lawn. Being so small, they cannot, of course, be considered an economic table fowl, but are good layers, while as pets they are without a rival, being of a brisk, happy, docile temperament.

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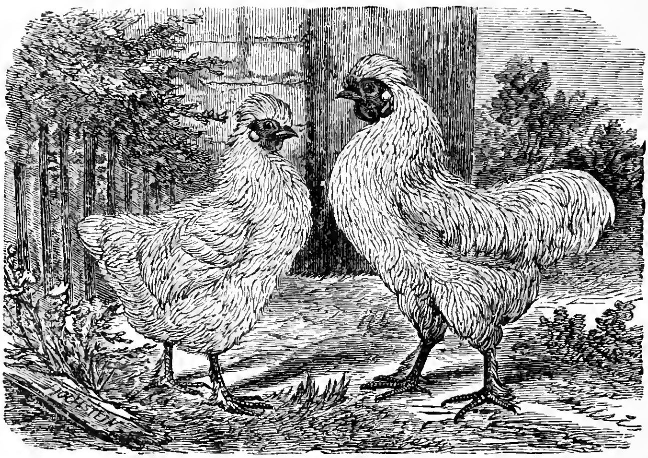
## SILKIES.

THIS breed, sometimes called Silky or Negro fowls, have a very peculiar appearance; their plumage being so unlike that of other fowls, as to be scarcely recognized as feathers; while the skin of the fowl is a deep violet color, almost black, the surface bones being of the same hue also, which gives it rather an uninviting look when prepared for the table; the flesh, however, is very delicate and white, and superior to that of many breeds. The plumage has a soft, flossy appearance, the filaments being separated or single, and has been represented by ancient naturalists as resembling wool. In describing a certain peculiar

breed of fowls, some say "they were covered with wool, instead of feathers"; others, that they were covered "with hair like cats." These fowls are supposed to be natives of India, though some claim the origin to be attributed to China. Mr. Wright describes the plumage of the fowls as follows: "The feather of the Silky fowl differs from that of others in several respects. In the first place, both the stem and the fibres which proceed from it are very thin, weak, and non-elastic, so that the fibres have no tendency to assume a position opposite each other, but hang about in a lax and indetermined manner; and secondly, the fibrils are also very weak and thin, besides being so sparse that they cannot be seen and counted with the naked eye, or a very low magnifier; while in an ordinary feather many hundreds occupy the length of one inch. The fibrils of the Silky also extend from the main fibres at nearly equal angles, being thus destitute of the interlocking power we have just described. The consequence of these variations in structure is a loose and flossy character."



WHITE SILKIES.

Mr. Wragg, of England, a breeder of these fowls, describes them thus: "Silkies may be classed as purely fancy fowls, having little but their unique appearance to recommend them. Instead of feathers, they are covered with an abundance of white silky hair; the wing and tail-quills also being hung with long silky fringe. The skin and legs are blue, the face and comb a deep purple color, ear-lobes being slightly tinged with white. The best specimens have five toes, and are feathered on the legs. The plumage should be pure white. The cock should have a full, prominent breast; neck medium size; hackle very full, flowing well round the shoulders and on the back; saddle square, and rising upwards to the tail, which should gradually rise a few inches and then droop over. The comb is double, but is wider than long, having a lumpy appearance, with scarcely any points on the top. It should be well on the front of the head, and behind it, should be a spur or crest of feathers projecting straight out, about two inches in length. The weight of the cock averages about four pounds. The hen is rather small in proportion, weighing only about two and a half pounds. She is square and compactly built, breast being full and round, neck rather short, saddle square and well cushioned, tail almost buried in fluff, which is very abundant, and a fine

small head, from the top of which should rise a small globular crest. The general style and shape is very attractive. I consider Silkies hardy. The chickens are easily reared and generally very true to their parents. They are very moderate layers, but capital sitters. In hatching and rearing Bantams, Pheasants, or Partridges, they are unequaled." The loose and fluffy character of the plumage of these birds makes them seem larger and heavier than they really are.

**Merits and Defects of Silkies.**—The merits of these fowls have been mostly given in the previous descriptions. Some breeders call them good layers, others say they are deficient in this respect; but from what we can learn of them generally, they are only moderately good in this respect; their eggs are rather small, and of a delicate cream color. They are quite hardy and easily reared, and make excellent mothers to Bantams and other delicate breeds, their long, soft, and silky plumage furnishing a nice protection to tender chickens. They are, however, peculiarly susceptible to cold and wet, and should always be provided with a good shelter. Their flesh, though unattractive in appearance as a table fowl, owing to the dark color of the skin and bones, is very white and nice. They are, however, kept principally on account of their unique and singular appearance, and for mothers to delicate breeds.

## DUMPIES OR CREEPERS.

THIS breed was formerly very popular in Scotland, and have been known by the name of "Bakies" and "Go-laighs" in some localities. They are at present very rare, however, especially so in this country. Their principal peculiarity is the extreme shortness of the leg, which is only about two inches from the hock joint to the ground, and gives the bird the low appearance of almost creeping on the ground. They are not uniform in color, the plumage being generally speckled, though the general appearance of the body is similar to that of the Dorking (lacking however the fifth toe). The weight of the cock is from six to seven pounds, that of the hen about a pound less.

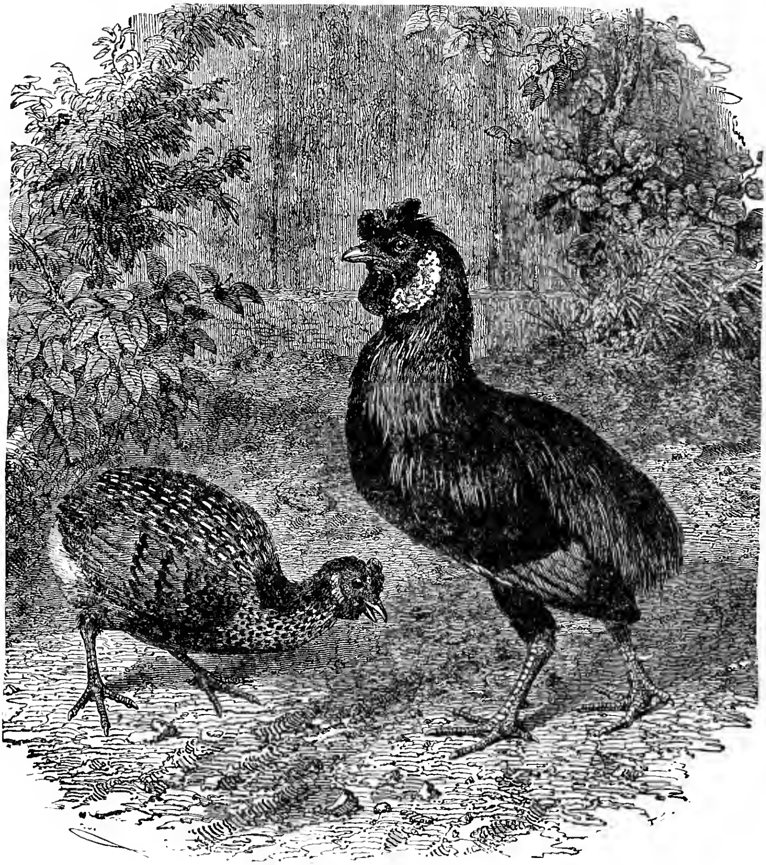
**Merits and Defects of Dumpies or Creepers.**—The hens are excellent layers of large-sized eggs. They are also the best of mothers, and are a first-class table fowl, the flesh being peculiarly white and delicate in flavor. They are hardy and easily reared, and make a good cross with the "Long-legged" breeds, owing to their shortness of leg, thus reducing the stiltiness of some breeds to the "happy medium" that is something desirable.

## RUMPLESS FOWLS.

RUMPLESS fowls are not only wanting in tail feathers, but their anatomy shows that the caudal projection is wanting, and also even the final vertebræ of the spine itself. This gives them a very peculiar and grotesque appearance. It is supposed that these originated from the Polish breeds, and that some of them were formerly crested with partially-developed beards, with leg feathering and vulture hocks, but these have been bred out. Their anatomy being deficient in the usual prolongation of the vertebral column upon which the tail feathers of the fowl are planted, renders them devoid of this ornamental appendage, the back part of the body being covered by a few back or saddle feathers. They

were formerly bred mainly black in color, or a mixture of black and white, but are mostly found now pure white. They have been somewhat improved by breeding, but are rarely seen.

**Merits and Defects of Rumpless Fowls.**—These fowls are fair layers, but the eggs are not apt to be as fertile as other breeds. As sitters and mothers they do very well,

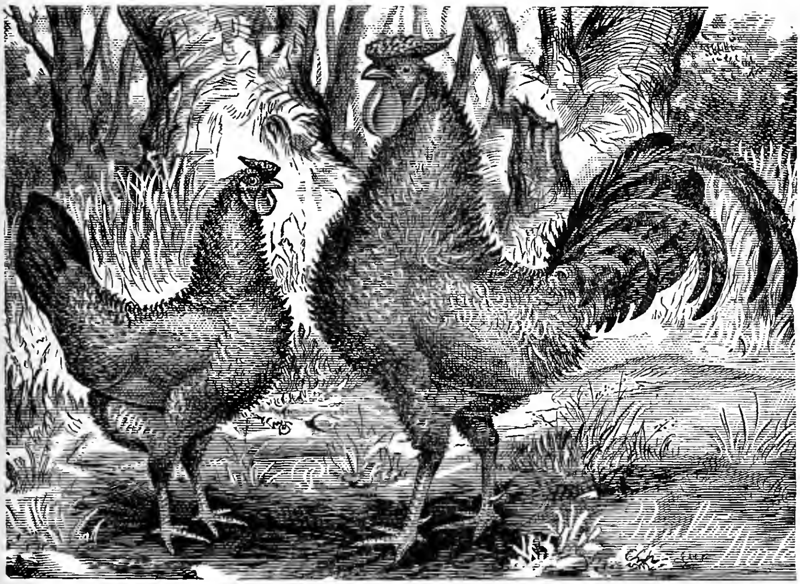


RUMPLESS FOWLS.

while as a table fowl they are about of an average quality. They are also considerea quite hardy, but we doubt much if this breed ever becomes much of a favorite, since the absence of the tail is really a deformity, and a tailless bird can never be called handsome. They are curiosities, and will probably be bred as such more than for any prominent excellence or snperior merit.

## FRIZZLED FOWLS.

THE term "Frizzled" is applied to fowls the plumage of which has a tendency to curl backward, "as if the bird had been stroked the wrong way," as some have described it, and not only that, but to curl up at the ends, especially in the hackle and saddle feathers. This feature is most prominent, though the plumage throughout is involved. This is not true of the tail feathers, although the webs even of these are loose and disconnected. They are of diverse colors, though the white and black varieties are the most common. The chicks feather slowly, and show a tendency for the curling plumage as soon as it is perceptible. The combs are generally rose, though sometimes single. They breed true to feather, seeming to possess peculiar power to reproduce the frizzled plumage. In form they are long-



FRIZZLED FOWLS.

bodied, square and plump, with a prominent, wide breast and broad back. The neck is rather short and well curved; the tail of medium size, and carried rather upright. The legs are of medium length; the carriage quite sprightly and animated. This fowl is common throughout Southern Asia, Java, Sumatra, the Philippines, and Ceylon. It is also found in the West Indies.

**Merits and Defects of Frizzled Fowls.**—These fowls attract great attention at poultry shows on account of their very singular appearance, and are probably bred more for their extreme oddity, than any other reason, although they possess some very excellent qualities as fowls. They are very early layers, as they are usually through the moulting process sooner than other breeds. They are said, by those who breed them, to be also very good

egg-producers, as well as an excellent table fowl; the meat being very white, and the bones small. They are also good mothers, the peculiar character of their plumage seeming to keep the eggs and chicks warmer than the ordinary feathering. The chicks feather so slowly, however, that they require to run longer with the hen than most breeds.

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## THE GRAY LIVONIAN FOWLS.

THIS breed of fowls is a native of the province of Livonia, Russia, and much resembles the American Dominique in its plumage, which is of a gray color, barred similar to that of the latter. It is large and deep-bodied, with a broad, prominent breast. The comb is low and broad, with the projecting spike; the beak dark, short, and strong, and remarkably hooked, with the large cavernous nostrils peculiar to the Polish varieties. The legs are of a bluish leaden color; the carriage is upright, bold, and proud. They are said to be very popular and much preferred to other breeds by poulterers in Lithuania, Courland, and as far north as Finland, as they are exceedingly hardy, and are possessed of a stamina and constitution requisite to a cold climate. The hens are darker in color than the cocks.

**Merits and Defects of Livonians.**—It is said that Denmark, which recently exported over a million dollars worth of eggs, is especially favorable to this breed. They are excellent egg-producers, extremely hardy, and suited to a severe climate; they are consequently easily reared. Although not possessing much beauty of plumage, they are otherwise very desirable, the flesh being very tender and delicate in flavor. We doubt not this breed would be a very valuable acquisition to our already numerous varieties, being especially adapted to our northern climate.

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## BANTAMS.

THESE diminutive specimens of poultry cannot fail to attract attention wherever seen, whether in the yard or at the poultry shows, which have become such an important institution in this country within a few years. They are also very popular among poultry keepers, their quaint little ways, proud and strutting manner, as well as gentle and tame disposition, rendering them not only comic, but interesting tenants of the poultry yard. The Bantam cock is the very personification of happiness and conceit in feathers, and, as is often the case with *some* small *human* specimens, bustles about with the air of self-importance and superiority, combined with quick resentment at the slightest imagined insult or invasion of his rights, in a manner that is intensely amusing, and as though he considered himself the largest and most important of all living creatures. More especially is this true of the Game Bantams, which never hesitate to attack any fowl, no matter how many times larger than himself he may be These little birds, with their ludicrous ways, would pay a fun-loving person for their keeping, for simply the amusement they afford, even if for no other reason; but they are really a profitable fowl, and amply repay for all their care and expense. They require but little room, are contented in confinement, and eat almost nothing compared with larger breeds, while they are very good layers.

We append the following on "Bantams for Children" which has been going the rounds in the Agricultural and Poultry journals: "Show us the boy who is fond of pets and takes especial good care of them, rearing the young successfully year after year, and we can then


JAPANESE BANTAMS.
Owned by W. R. Andrus, East Orange, N. J. (Weight of the cock represented, 24 ounces; weight of hen, 15 ounces.)

point out to you one who will be successful as a stock-breeder in future years, whether he breeds poultry or larger stock. To many children, girls as well as boys, pets of some kind are a real necessity; and the love for pets should be fostered by the parents to the extent of their ability. Aside from the pleasing appearance of pets, there is a real benefit which you confer on your children by giving them pets to care for; for it engenders habits of usefulness, and gives them something to care for regularly, which habits cannot be formed too soon. This point is not sufficiently considered, though it is worthy of mature consideration.

No neater, prettier, or more attractive pets can be given to the little ones of the household to care for, than Bantams; for their small size and handsome plumage and proud ways, make them objects of unfailing interest. They can be kept in a small yard, if necessary, and do not require very great care. They are hardy, and many an enterprising boy has put a number of stray dollars in his pocket from the sale of his surplus stock — money which he prizes far more than that which he did not earn by his own exertions. A boy must learn to *contrive* as well as work, and *save* as well as earn, or he will be good for nothing."

The principal varieties of Bantams are Game (which includes almost every variety of the Game fowl), Rose-combed Black, Rose-combed White, Golden Sebright, Silver Sebright, Nankin, Japanese, Pekin or Cochin, and Booted White: besides these, there are other varieties less common, such as the Cuckoo Bantams, etc.

**Game Bantams.** — These are diminutive specimens of the Game fowls, which combine the beautiful outlines and plumage of the latter breeds, with the small size of the Bantam, and were produced by crossing the English Game fowl with the Bantam, and repeatedly selecting for stock-birds those chickens which most closely resembled the Game, thus breeding in-and-in, until the desired size was reached. This creation, as it were, of the Game Bantam breeds, is one of the most striking illustrations of the breeder's art, and the triumphs that can be attained in the direction of change and the formation of new breeds. The leading varieties of Game Bantams are Black-breasted Reds, Brown-breasted Reds, Dorkings, and Piles, although nearly every variety of the Game breed is represented in these Games in miniature, and which closely resemble their larger brethren in all points except size. The average weight of the full-grown cock is from twenty-two to twenty-six ounces, that of the hen about twenty ounces. In breeding these little birds, the great points aimed at are the general shape or contour, good feathering, and color. To avoid repeating these points, the reader can refer to the description previously given of Game varieties. which will be found sufficiently definite for all purposes.

For breeding good Game Bantams breeders of experience advise selecting and mating the birds early in January or even earlier, with one cock to about four hens that are from eighteen months to two years old, and one can *then* commence setting the hens about the last of February. They will generally hatch a little sooner than the larger breeds, and usually on the nineteenth or twentieth day, if the hen is a good sitter. They can be hatched all through the spring until the first of June, and—as our opinion—we should say it were advisable, in our northern climate, to delay hatching till the last of April or first of May for such diminutive chicks. The eggs hatch better on the ground, with a little hay or straw for lining. since the moisture thus derived from the earth seems to be beneficial to the eggs. In very warm weather many breeders sprinkle the eggs with warm water each day for two or three days previous to hatching; that is, beginning about the fifteenth or sixteenth day of the sitting. The chicks will not require food for the first twenty-four hours after hatching, and should then have boiled egg chopped fine given them, or a little custard of eggs and milk mixed with soaked bread crumbs. The chicks are quite hardy, but the hen should be confined in a coop of good size until they are at least five weeks old, and should have access to fresh grass, fresh earth, and fresh water. We do not approve the recent idea of some breeders of the "no water" principle for fowls of any kind, whether young or old; they

need it as well as other creatures, and we believe the Creator provided it as much for them as other living things. One not accustomed to the care of fowls would be surprised at the quantity of water fowls will drink when having free access to it, and such fowls always seem to thrive best and be the most free from disease.

Game Bantams are said to be quite hardy, and as table fowls, what there is of them is exceedingly delicate and fine flavored, making a very good substitute for partridges. The hens are quite good layers, good sitters, and the best of mothers, tenderly caring for their chicks, and defending them against all intruding enemies of the poultry yard.

**Rose-Combed Black Bantams.**—This variety, sometimes called the Black African Bantam, is a perfect specimen of the Black Hamburg fowl in all respects, except size, also the points of the wings drooping; having the same general contour, the rose comb with its terminating spike behind, white ear-lobes, plumage, and color of beak and legs.

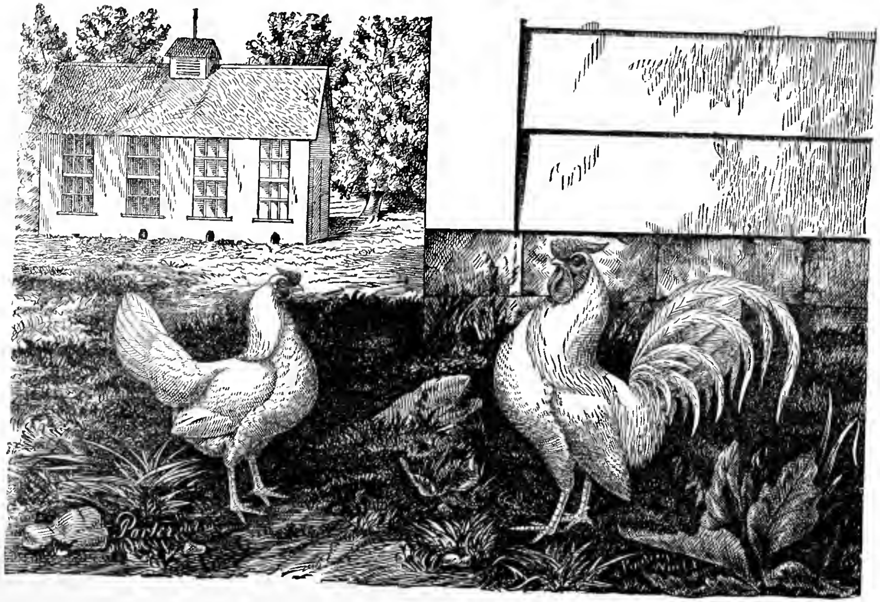
The size of the birds varies, of course, somewhat; the cocks will weigh from fourteen to twenty-eight ounces, and the hens from twelve to twenty-four ounces; cocks from eighteen to twenty ounces being usually regarded as the best birds. The disqualifications for this variety of Bantams, given in the Standard, are: "Cocks weighing more than twenty-eight ounces; hens weighing more than twenty-four ounces; cockerels weighing over twenty-four ounces; pullets weighing over twenty-two ounces; red ear-lobes; feathered legs; legs other than black or deep leaden blue; combs other than rose; natural absence of spike; birds not matching in the show-pen; crooked beaks; wry tails, or any other deformity."

This little bird has a very upright, strutting carriage, his neck curving backward so as to bring the head quite near the tail. The back is short, the breast round and quite prominent, and the body plump and well proportioned. The tail is quite full, with long sickle feathers, which are carried well up towards the back of the head. The entire plumage is a glossy black, with greenish reflections. The legs are black or dark leaden blue, and the beak also black or nearly so.

They breed quite true to color, and are among the best for laying qualities among the Bantam race. The egg is large in size in proportion to the size of the bird, and peculiarly delicate in flavor, the yolk being large in proportion to the white, and not as strong in flavor as the eggs of larger breeds; they are said to be particularly prized by invalids. These birds make very pretty pets. The chicks are said to be rather delicate when about five or six weeks old, owing to the rapid growth of feathers, being nearly in full plumage at three months of age. Mr. E. Cambridge, an English breeder, says of them: "They do not require a large run, and will do well on a lawn or in a kitchen garden, the hen being cooped. A farm-yard would be a ready-made *grave-yard* for them. Egg and bread-crumbs, and barley or oat-meal is the best food for them at first; afterwards grits occasionally, which they are very fond of. Any artificial or forcing food I consider bad for any fowl, but especially Bantams. When about four months old I separate the cockerels and pullets. By this means several of the former can be kept together, whereas, even at that early age, being very fussy and pugnacious, they would fight and disfigure one another if left with the pullets."

In selecting for stock-birds, it is very desirable that the most perfect specimens in all respects should be taken for this purpose, since a single slight deformity or defect is quite liable to be transmitted to the progeny. This is one of the oldest of the Bantam varieties, and has been greatly improved within a few years, by careful breeding. As they now breed very true to color, and have attained the desired shape, carriage, and size, we can scarcely perceive how any additional improvement in them could well be made.

**Rose-Combed White Bantams.**—This class of Bantams should be similar in general respects to that just previously described, except the color of the plumage, which is pure white throughout. The beak and legs, however, should be in color white or yellow, both



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being admissible; the ear-lobes should also be red instead of white, as in the Black; these being the only essential differences in the two varieties. In all other respects, consequently, what we have said of the Black Bantams will apply to the White.

The points, as given above, are in accordance with the American Standard, but we find that the English Standard requires for this breed *dark* legs and beak, and *white* ear-lobes, making the only essential difference between the two varieties—Black and White—the color of plumage. We certainly think "Brother Jonathan" shows a decidedly better taste in this respect than "John Bull," since, with a pure white plumage, the contrast of the bright-red ear-lobes would produce more of beauty in the effect than the white, which would give a sickly appearance to a white-plumaged bird. We admit that white ear-lobes, with *black* plumage, add much to the beauty of a fowl, and with the bright-red wattles and comb make a very pleasing contrast. It is doubtless a matter of surprise and amusement to many of the uninitiated in the mysteries and interests of poultry breeding that fanciers should be so particular about the minor details of a fowl, such as the color of an ear-lobe or the tint of the beak; but when they come to understand the subject more fully, they will find that it is only by the greatest care and patient, persistent efforts in all such seemingly minor matters that our to-day valuable and beautiful breeds of poultry have been produced, and great credit is due those who have accomplished such truly wonderful results!

Those birds having the points of the wings drooping so as nearly to touch the ground are considered the most beautiful and desirable. Like all the Bantam varieties, they are very pretty pets.

**Booted White Bantams.**—This is one of the oldest known Bantam breeds. They are very tame and hardy, and also exceedingly happy and contented in their dispositions. One writer has said of them: "They are the gamiest little fellows imaginable; pick up a cock from the yard, and he will crow in your very hands in the most defiant way. They are very prolific, though the eggs are not much larger than pigeons' eggs; and the hens make admirable sitters and mothers; but sometimes the length of the hocks makes them roll the eggs from the nest when leaving it. Three little hens I now have, with their chickens are making the most exemplary mothers." They are also harmless in a garden, or at least can do but very little injury, even in a flower garden, the long feathers on their legs making it very difficult for them to scratch; for this reason they would be just the breed for one to keep who had only a small yard or garden to keep them in, and consequently had no run for larger fowls.

The smallest specimens are considered the most desirable; their manner is very pompous, the carriage being upright and strutting, carrying the head well back toward the tail. The beak and legs are either white or yellow, though the white is preferred. The comb is bright red and single, the neck curving well back, and the hackle pure white, like the entire plumage. Their breast is round and carried quite prominently forward, while the body is short and compact. The wings droop somewhat; the tail is furnished with nice, long sickle feathers and is quite full and carried upright. The legs should be heavily booted and hocked, the latter feathers nearly touching the ground; the more heavily the legs are feathered the better. It is said by those most familiar with this breed, that they are quite liable to get sunburnt, like most white-plumaged birds, and when kept exposed to a strong sunlight without any shade, the neck hackles will turn yellow, which, of course, greatly mars their beauty. This can, however, be obviated, by having trees and other shade for their protection.

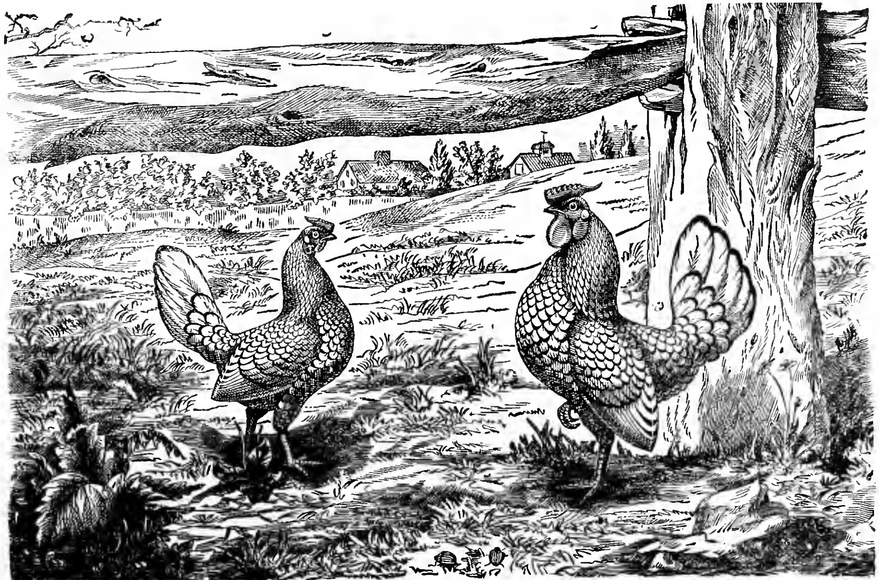
**Golden Sebright Bantams.**—With regard to the origin of this beautiful little fowl, as well as the Silver Sebrights, we can give no better account than that already given by Mr. Wright in his Book of Poultry: "The beautiful Gold and Silver Laced Bantams, also very commonly called Sebright Bantams, are perhaps the most extraordinary proof of what can

be done by careful breeding that could be found within the pages of this work. So entirely is every feature the result of art, and so well did Sir John Sebright (known as a skillful breeder of Shorthorns and other animals, as well as of poultry) keep his secret as to the process of manufacture, that for a long period the most erroneous and contradictory accounts are current as to the origin of these beautiful breeds, some affirming that they had been imported from the East. After the death of the right honorable baronet, however, truer accounts obtained from various members of the family, began to appear; and in the *Journal of Horticulture* for 1865, was published the fullest and most detailed account of the matter we have yet seen, as follows: 'It was about the year 1800 that the late Sir John Sebright first began to fashion the Sebright Bantam. The cross was between some common Bantams and Polish fowls. These were bred in-and-in until the required marking and size were secured.

Sir John then accidentally found a short-tailed Bantam cock in the country where he was traveling. This short-tailed bird he in-bred with his newly-manufactured Bantams, thereby giving their progeny the present form of the short tail. In the *Poultry Chronicle* it is stated that Sir John obtained a buff-colored Bantam hen; she was very small indeed, with clean slate-colored legs. On the same journey he purchased a cock rather inclined to red in color, destitute of sickle feathers, and a hen-like hackle; and also a small hen resembling a Hamburg. He afterwards had a white cockerel from the Zoölogical Gardens, by which he made his Silvers. This description of the origin refers back before the laced marking was achieved. They were then known as 'Pheasant Bantams.' These birds generally have a rare comb, that is, square in front, and terminating in a spike behind; the ear lobes are white; the wattles bright red, the neck is well arched, and the head carried well back, giving a very pompous, strutting carriage to the body; the breast is full and prominent; the wings carried quite low, the ends nearly touching the ground; the tail is entirely free from sickle feathers, similar to that of the hen; it is square and expanded, the feathers being broadest towards the ends. The hackle feathers of the cock are similar to that of the hen, as is also the entire plumage, being quite compact and close. The beak and legs are dark, the latter free from feathers and a slate blue color.

The entire plumage, including the feathers of the wings and tail, is a rich golden yellow, each feather distinctly and evenly bordered or laced all around with a narrow edge of black, which makes a most beautiful plumage; while their sprightly and pompous ways, their tame and familiar manner makes them very pretty pets. The great drawback to this breed is the failure in hatching, often only a small number of chicks being produced from a large number of eggs. They produce a large number of eggs, however, and are considered quite as hardy as the average Bantam varieties. The young chicks should not be overfed, many being killed by too great kindness in this respect. They should be fed at first with custard, oatmeal, boiled eggs chopped fine, boiled rice, and curd made by scalding loppered milk and draining off the whey; though they should be fed very sparingly of the boiled eggs for the first few days, it being rather strong food for them when first hatched. For this beautiful bird, originated in England more than eighty years since, great credit is due Sir John Sebright. He has not only given us a bird of exquisite beauty and form, size, and color, but has shown the world what the breeder may accomplish by patient perseverance and skill.

**Silver Sebright Bantams.**—This variety is precisely like the Golden Sebrights, previously described, in all respects except color of plumage; that being a rich golden yellow, with each feather laced with a narrow border of black, and this in plumage, being a silvery white with each feather even and distinctly bordered with a narrow edge of black, as shown in the cut, which represents birds bred by Mr. Gamerdinger of Columbus, Ohio, even the wings and tail feathers should have this peculiar marking, which is extremely beautiful in effect. The beak and legs are dark as in the Golden variety. The feathering of each is



SILVER SEBRIGHT BANTAMS.

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compact and close, the cock, like the hen, being devoid of hackle, saddle, or sickle feathers. The ground color should be clear in each variety, and whether Gold or Silver, the lacing should be narrow and distinct, and never spotted. The eyes are large and bright, and the carriage vain and pompous, strutting about in the most ludicrous manner.

**Japanese Bantams.**—This breed, though rare in this country, is becoming quite a favorite where well known, and we doubt not that it will soon become as common as many of our most familiar breeds. As the name indicates, they are imported from Japan, and seem to be easily acclimated and quite hardy, also easily reared, while their appearance generally is so unique and beautiful that they cannot fail to attract admiration, even from the most practical and prosaic. The plumage of these birds is pure white, except the tail, which in the cock is a rich black, each feather having a narrow edge of white distinctly marked around it, similar to the Silver Penciled Hamburgs, which gives a beautiful contrast with the glossy black. The tail is also very large, compared with the size of the bird, is full and upright, nearly touching the back of the head, and flows in a sweeping semi-circle. The sickle feathers are very long. The head is rather large, the comb is bright red, standing erect, and evenly serrated; the ear lobes and wattles are also bright red; the neck is rather short and carried well back; the breast quite prominent and full, body short and compact, and the wings large and long, the points carried drooping. The back and legs are yellow, the latter quite short and free from feathers. The plumage is pure white except the tail. These little birds breed true to feather, are quiet and easily tamed, while their beautiful plumage and proud carriage renders them exceedingly attractive, and highly ornamental to any yard or lawn. The eggs, though small, are very delicate in flavor. The originals from which the full page cut of these birds was made weighed,—cock, twenty-four ounces; hen, fifteen ounces.

**Nankin Bantams.**—This is an old, and now very rare breed, they being seldom seen at shows. The color of the hen is similar to that of the Buff Cochin, the hackle being darker, also the tail feathers tipped with black. The color of the cock's plumage is considerably darker than that of the hen, the tail being a glossy black, and quite full and sweeping, though some very fine specimens have the tail of a chestnut or copper-color shading into black; but the jet black is preferred. They vary more than most varieties, as the hen is often of a light canary color, with tail of a rich brown, shading into black at the end. The legs are unfeathered, and usually dark in color, though sometimes white; the dark, however, are preferred. They are said to be very tame, excellent layers of eggs large in proportion to their size, and very careful mothers. The smallest specimens are considered the most desirable.

**Pekin Bantams.**—This variety, sometimes called the "Cochin Bantam," is a native of China, and was first shown in England in 1863; the progenitors of those then exhibited having been stolen from the Summer Palace at Pekin during the Chinese war, when—during the Anglo-French Expedition in 1860—that palace was sacked.

It is, size excepted, like the Buff Cochin, not only in color, form, feathering of the leg, and abundant fluff, but in the other characteristics. The legs, however, are shorter in proportion, than the large breed. They are very tame and docile, and, like all the Bantam

breeds, make excellent pets. It is said that they are much attached to each other, though they seem shy of other breeds. They are fully fledged at two months of age, and breed very true to color. They are contented in confinement, but seem to thrive best when they can run about and get worms and insects. They are considered rather delicate, which has probably resulted from interbreeding, necessitated for lack of new blood from fresh importations. They have increased in vigor by crossing with other feather-legged Bantams, and then breeding back to the pure strain. It is quite unnecessary that we should give a minute description, as they are but diminutive Buff Cochins, and that breed has already been fully described.

**Merits and Defects of Bantams.** — We have referred so frequently to these points in giving descriptions of the several varieties, that to write at length under this heading would be a repetition of what has already been stated; therefore we will summarize briefly as follows: They are the most interesting and gentle of pets among the feathered race, while their pompous and quaint little ways, combined with their beautiful form and plumage cannot fail to awaken real interest in those having their charge. They are almost harmless in a garden, even where choice flowers are cultivated, and they do much good in ridding it of worms, grubs, and insects.

Though small, they are very dainty eating, and are a good substitute for partridges. Most of the varieties are good layers, and the eggs are very delicate, and much prized by invalids, being free from the strong flavor found in those of most of the large breeds. They eat but little, consequently are economic fowls to keep in this respect, and they require so little room that they can be kept where other fowls could not. A house two feet square for them to roost and lay in, and a small garden for a run, is said to be sufficient room for five or six of these little birds. The Game Bantams are the most hardy.

The main point in breeding Bantams is to keep them small, and care should be taken not to over feed, or to give too much food that is bone-making in its tendency. The chicks when first hatched should have a little extra care to keep them warm and dry, for at least the first two or three weeks; after that they are as hardy as other breeds. Some breeders resort to late hatching to preserve the small size, but this has been found to injure the plumage, which in the development of the tail of the cock, renders the bird almost worthless as far as beauty is concerned. We believe it is the general verdict of breeders that have had experience with Bantams, that for the amount of care and food, they furnish as much in return as any of the larger breeds, while as pets for children there is no more suitable or pretty fowl.

# GENERAL MANAGEMENT OF POULTRY.

IN order to make poultry raising profitable, certain things are essential, such as proper buildings, sufficient range, suitable food of proper quantity, access at all times to pure water, etc. Farmers who permit their poultry to pick up a precarious living, roost in the winter in the apple trees, and care for themselves generally, as was formerly the practice in many localities, cannot expect to attain the highest success in poultry raising. In such cases eggs were rarely supplied to the family in winter, while the hens stole their nests in summer, which were perhaps not found until the eggs were past being suitable for use, or the hen appeared with her family of chicks about the farm house, this frequently occurring so late in the season that the chickens could not possibly be of any profit to raise. How often have we known the good housewife, standing in some farm house door, with sleeves rolled up to the elbows, and hands whitened with flour, call to "one of the boys" to hurry and look up a nest, because eggs were wanted at once to finish the baking. And so the search would commence, ladders and scaffolds were climbed, hay mows searched, sheds and shed lofts carefully scrutinized. An opening under the barn would be utilized as a means of access to the wide range afforded under the barn floor, or perhaps one or two boards would be taken up in the barn floor to admit of access to this place so delightful often to a hen, as a place of security for secreting her nest. Piles of old rubbish would be peered under, every currant bush and place of security in the kitchen garden searched, until covered with cob-webs, dust, and hay seed, and tired out with the effort, the task might perhaps be rewarded with a few fresh eggs, but quite as frequently with those past their state of usefulness as an article of food.

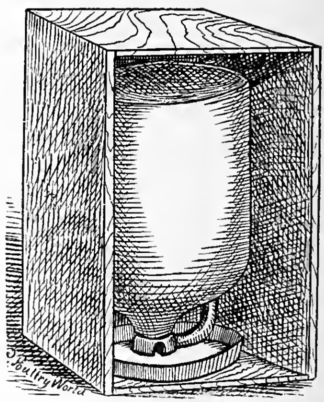
Intelligent farmers of the present day have learned that there is an easier and more profitable method of managing poultry than this, and so on the best kept farms, those where the general appearance is indicative of the most thrift and judicious management, we see a better system adopted, where the commodious and tasty outbuildings of the farm have somewhere ample provisions provided for the comfort and care of the poultry, as well as the other domestic animals on the farm. A poultry house need not of necessity be expensive, but it should be comfortable and provide warm quarters for the poultry in cold weather, and shelter from the storms at all times. But the rearing of fowls need not necessarily be restricted to the farm. A constant supply of fresh eggs may be had by keeping poultry, whether on a farm, or even a village or city lot. With the average farmer, fowls are permitted to have free range about the farm, where they obtain a large portion of their living, especially insects, grass, and a variety of other food. They are scavengers with respect to clearing the premises of insect pests, grasshoppers, beetles, grubs, etc., sometimes proving very useful in aiding the farmer by exterminating the beetle or potato bug from a potato field; some hens, however, will not eat the latter insects.

We know of nothing better for a farm garden in ridding it of insects and small worms, than to have a chicken coop located near its center, where the young chicks can forage all they wish. The chickens cannot scratch enough to do mischief in that way, while the hen, being confined within the coop, will keep a sharp look-out for danger, and give any necessary call of alarm. It is an interesting sight to see a flock of hens follow a fresh-turned furrow and pick up the worms, beetles, etc., that are distributed throughout the soil, none escaping their keen eye. A flock of chickens are also of great service in an orchard, in freeing it from injurious insects. A gentleman in France, owning a fine estate, planted near his mansion large orchards containing all the choice fruit trees that could be acclimated, among which were about three acres in plum trees, which were healthy looking, grew finely, blossoming every spring, but owing to the ravages of the curculio the fruit never came to maturity.

Becoming disgusted, he turned this plum orchard into a chicken yard, leaving the plum

trees for shade. To his surprise, the following season the plum trees were heavily loaded with full, matured ripe fruit. The poultry had completely exterminated the curculio, which had previously ruined the crops of plums. We recommend this experiment to those who have failed in raising plums on account of this pest.

There are many breeds of fowls that bear confinement well, and are hence adapted to a limited enclosure, having perhaps the run of a small yard; but in such cases, they should be supplied with green food in summer, together with a certain amount of meat, to make up for the lack of insect food to be obtained in having a free range. Other conditions being equal, that poultry will thrive best, that has considerable range. The surroundings for poultry should always be kept clean, and the poultry house free from vermin of all kinds. Pure air should be supplied by proper ventilation, while the water should be fresh and clean, and the food at all times of suitable quality. Never throw grain, or any food for them, in a dirty place, where, in order to obtain it, they must also take up sand or dirt. Put the food in a clean place, whether in troughs prepared for feeding or not, and so arrange their watering tank that the water cannot become foul by their getting their feet into it, or by other means. A very cheap and convenient drinking fountain can be made by filling a three-gallon jug with water and turning it mouth down in a suitable shallow dish, provision being made for properly supporting the jug. The accompanying cut represents the idea very accurately.



DRINKING TANK FOR FOWLS.

When confined with a limited yard for exercise, it will be always well, if practicable, to permit them a run for an hour or so just at night, when they will not wander far from their quarters. They will greatly enjoy this freedom, and it will do them much good, giving them the opportunity to catch a few insects, eat green food, and obtain considerable exercise.

**Care of Poultry in Summer.**—Although when having a free range in summer, poultry will not require as much care as when kept confined, still they should be fed with regularity, and have constant access to clean, fresh water. When kept in limited quarters in towns and villages, fowls will need fully as much attention in summer, if not more, than they will in winter. In summer, vermin are apt to be more troublesome than in cold weather; and these must be avoided. The pens and yards will require considerable care to be kept clean; the poultry building should be well ventilated; clean, fresh water must be supplied, and wholesome food in variety furnished in such quantities that it will not become stale and unfit to be eaten.

In feeding, whether in summer or winter, the amount of food given should always be such that it will all be eaten up clean, and nothing left over. Poultry will not furnish a good supply of eggs unless they are kept healthy; and they will not remain healthy unless the proper sanitary conditions are observed. To attend to all the essentials requisite in maintaining these conditions, will require some time and labor, but there is no business whatever that will result in profit or success, without this.

Eggs are apt to fall off in very hot weather in summer in consequence of the unfavorable conditions of the season, unless these unfavorable conditions are met and overcome by proper care. The best economy, then, demands that the poultry yard and house have daily care throughout the hot weather. The droppings under the roosts and in the pens should be daily removed, and the perches occasionally washed with kerosene oil, or smeared with lard

WHITE COCHINS.

and sulphur, mixed. Dust baths should also be furnished, in which they may scratch; common soil, road dust, or coal ashes will do for this purpose. If practicable, the hens should be permitted to leave the yard for an hour towards night, thus giving them the benefit of exercise, and scratching in the garden among the grass or fruit trees. While they are enjoying this exercise, a portion of the yard should be spaded up, so that they can have access to fresh earth worms and grubs, which they will be busy in finding early the next morning. When kept in confinement, fowls should also have fresh grass thrown into the yards, since they require considerable green food. The feed should be varied and frequently changed, consisting of corn, oats, buckwheat, wheat, barley, mush, scraps from the table, mashed boiled potatoes, meat scraps, etc. Green food is also relished by them, such as green turnips, beets, cabbage, and occasionally onions chopped fine. The latter are very healthful and are much relished by hens. If fed to them more frequently than once a week or ten days, however, it will have a tendency to give the eggs an unpleasant onion flavor. They should always be supplied with ground shells, broken bones, and plenty of gravel. Coal ashes containing small clinkers may be furnished them, as well as bits of broken plaster. When thus cared for, there will be no lack of eggs during the hot weather, and the results will well repay for the care and labor bestowed.

**Care of Poultry in Winter.**—Whether a large or small number of eggs be supplied by the hens in winter, depends on the care they receive. Mr. Alexander Hyde says on this subject: "In the summer, hens that are allowed a free run of the farm can scratch for a living, and generally can pick up enough not only to keep soul and body together, but also to develop new life in their ovaries. Not so when the ground is frozen and covered with snow. Biddy finds scratching at this season a hard business. She now requires more food to keep up animal heat, and to expect eggs from her without furnishing her a comfortable room and suitable material for manufacturing them, is as unreasonable as it was in Pharaoh to exact the regular toll of bricks from the Israelites without furnishing straw with which to burn them. The profit from hens is small if they lay only in summer, and make no returns in winter.

The complaint of the old woman who said, "My hens are good-for-nothing critters; when eggs are cheap they lay, and when eggs are dear they lay nary a one," had some foundation, but the trouble was not with the "critters." Hens are just as ready to lay in winter as in summer, provided the conditions are all right; and as eggs bring double, if not triple, price during the cold season, the net income may be made as great at this time as in summer.

The question then returns, what are the conditions that will make hens profitable in winter? There are only two. The first is a warm, well-lighted, well ventilated, and every way comfortable hennery. The hen is a native of a warm climate, and our cold air and frozen or snow-covered ground are not congenial to her. When compelled to wade in the snow she treads lightly, often holding up one foot to warm it in her feathery muff, and if left to roost upon a tree, she turns her head windward, so that the breeze may not ruffle her feathers, and the careless farmer may think she is comfortable, but frozen toes and combs are often the result, and if any one expects his hens to give their energies to the manufacture of eggs, when they are all required for fighting the frost, he expects too much. The hennery need not be an extensive structure. Much useless fancy work is often expended upon it, as if hens, being beautiful animals, must needs demand a beautiful house; but they know no difference between a shanty and a palace, and will lay just as many eggs in a hemlock box, as in one made of mahogany.

Let the rich poultry fanciers spend as much as they please upon biddy's house, but the farmer who has an eye to profit has no occasion to invest much capital in poultry fixtures. The most successful hennery I ever saw was in the basement of a shed built on a side hill,

facing the south, and having a well-glazed front, with tight walls on the north, east, and west. The apartment was simple enough to suit the taste of Diogenes, but cozy and comfortable enough for a prince of the Brahmas, or a princess of the Cochins. The windows on the south side were made to drop from the top, so as to let in fresh air, and a wooden tube a foot square, leading to the roof. furnished an outlet for the foul air. The sides and ceiling were plastered and whitewashed. and the floorless bottom was well covered with coal ashes and sand. Here the tender White Leghorns lived, loved, scratched, laid eggs, cackled, and slept with no frost to nip their combs or crack their eggs.

Such an underground room has greatly the advantage over a hennery built, as so many are, exposed on all sides to the cold winds. It is almost impossible to keep the latter warm enough without a stove. The yard of the henuery above referred to was simply the barnyard, to which the hens had access at all times during summer, and every pleasant day in winter. There is great economy in letting hens run in the barnyard. They take to the dunghill so naturally that they are sometimes called dunghill fowls. Here they find many grass seeds, not a little partially digested grain, and what is most congenial to their taste, lots of maggots.

This leads me to say that the second essential condition for the winter profit of hens is suitable food. Exactly what raw materials, and what proportion of them are required for the manufacture of eggs, may be learned from an analysis of the egg itself. That of the average hen weighs 1,000 grains, and consists of the shell, weighing 100 grains, composed of carbonate of lime; the yolk, weighing 300 grains, composed of water, albumen. and oil. or fat; and the white, which, aside from its water, is pure albumen. The amount of water in a fresh egg is about the same as in fresh meat—from two-thirds to three-fourths of the whole. Prof. Johnston gives the components of an egg, aside from its shell, as follows: Water, 666 grains; albumen, 127 grains; fat, 94 grains; ash 13 grains.

It will be seen from this that an egg is really animal food; indeed, it is richer in fat than fat beef. That it has all the components of an animal is also manifest from the fact that a chicken (bones, feathers, flesh, every part) is made from it. The food, therefore, of a hen expected to lay eggs, must be such as will build up an animal. All the grains contain fat, gluten (the same chemically as albumen), lime, and other salts, but not in the same proportion. or so chemically combined as in an egg. It is therefore very essential that the food of an egg-producing hen should be animal to a certain extent. In the summer, hens running at large pick up a vast number of insects, either perfect or in a grub state, and these satisfy their wants; but when shut up, either summer or winter, some substitute for insects must be supplied. The refuse bones and meat of the house will often be sufficient; if not, lard or beef scraps, fed in connection with grain, will make hens lay abundantly. The most convenient animal food for hens is found in what is called animal meal. This is made from the refuse bones, blood, and meat of our large slaughter houses, being first steamed under high pressure, then dried and ground together as fine as meal. A quart of this animal meal, mixed with three quarts of equal parts of corn-meal and wheat bran, and wet up with skimmed milk, makes a mixture that will furnish hens with all the matérials they want for manufacturing eggs. unless it is carbonate of lime. This is best furnished in the form of pounded lime shells. I have tried this animal meal for ten years, and found it to work like a charm. It can be found at most of our feed stores, and the expense is not great, about twice that of corn-meal. The hens will be grateful, if along with their grain some fine cut cabbage or rowen is furnished them.

Eggs command so high a price in the winter, and are such a nutritious and easily digested food at all seasons, that farmers will find it to their advantage to produce a liberal supply for the family table, and a surplus for the market. He will show himself a public

benefactor, who makes his hens lay two eggs, especially in winter, where they formerly have laid but one." Hens should have plenty of sunlight in their pens in winter, consequently poultry-houses should have a southern exposure, and large windows for admitting it. Double

MAKING A CHOICE.

glazing of the windows, or green-house sashes are a great advantage to a poultry-house. It should also be dry, warm, and well ventilated. A coal stove, or an oil stove affords a good means of warming a hen-house, and can be managed with very little extra

labor. Give the fowls a hot breakfast every morning in winter. A mash of corn meal and wheat bran, in which a little salt and cayenne pepper is sprinkled is excellent for them in cold weather, and greatly relished by them. Potatoes, turnips, and carrots boiled, mashed, and fed warm are also good for them occasionally.

Save all the scraps from the table, and put them in a little water, and when hot, mix up with wheat bran or corn meal. Give also meat scraps in winter, as these supply in part the place of insect food in summer. Boiled sheep's pluck hung in the hennery just high enough for them to conveniently pick it off, is excellent; scraps from trying establishments are also good for animal food. Fowls should be fed at least twice a day, and many of our most successful poultry breeders feed three times. We would recommend the hot mashes for breakfast, and grain for the other meals, all kinds of grain and green food being given, as recommended in the summer care of fowls. Nice rowen, as previously stated, is greatly relished by hens in winter when they cannot obtain fresh grain. We usually keep a cabbage head hung up by the roots, so that the fowls can eat it whenever they wish, in our poultry-house in winter, and it is surprising what a quantity of such green food they will eat. Warm water should always be given for drink in winter.

**Food for Fowls.**—Fowls require a greater variety of food than any other of the domestic animals. Animal and green food are essential, although the bulk of the feed may be grain, either whole or ground. Any one having ever had the care of poultry, or an opportunity to observe their habits, must have noticed how quickly they will select the meat scraps first, from a mixture of table scraps thrown to them; also, when permitted to range, how eagerly they scratch and search for grubs, and jump and run after grasshoppers and other insects. They will even follow a cow in the pasture for hours, to catch the insects she stirs up, as she grazes. Flesh or fish, or even both should be given fowls when they cannot have access to insect food, as for instance, in winter, or when confined in summer. Corn, when fed in too large quantities, has a tendency to make hens fat, rather than produce eggs. Buckwheat and oats are better food for egg production than corn, although the latter should be fed in moderate quantities for a variety.

Barley of good quality, and wheat are also excellent for fowls. Corn meal and wheat bran thoroughly cooked and mixed with mashed boiled potatoes, and seasoned with a little salt and cayenne pepper makes a good food for fowls. It should be made stiff, fed when hot, and never in a sloppy condition. A little chopped onions occasionally mixed in, say once a week, is also good. A hot mash made of one-third wheat bran and two-thirds corn meal, and seasoned with salt and pepper is also excellent. Sunflower seeds are a valuable food for fowls, being oily and nutritious. They furnish one of the best egg-producing foods; fowls fatten readily upon them, while they keep them in excellent condition. In summer, hens will eat an astonishing amount of green food, such as grass, weeds, vegetable leaves, potatoes, tomatoes, and other vegetables, when they can have access to it, and this shows that they should have a supply of green food of some kind in winter. Apple and vegetable parings should be thrown to them to pick over, and rowen hay given.

An extensive poultry tender says: "As long as cabbages can be had, three or four heads a week are hung up in our hennery by a string around the roots, to a nail at a convenient distance from the floor, and the fowls eagerly eat all but the roots. Sixty fowls will consume a corn basket of hay every two or three days, in addition to the regular bill of fare. Employment is needful for them, so all the grain is scattered in the straw that they may enjoy the luxury of scratching; and while so occupied, they are not forced to pluck each other's feathers for amusement; for mischief is found for idle bills and well as for idle hands; though we think the constant use of salt has something to do with preventing this bad habit."

We have never tested fowls with ensilage, but we see no reason why it would not

be relished by them, and make an excellent substitute for fresh grass. Hens will also pick up a great quantity of grass and other seeds of plants in summer, such as timothy, meadow fox-tail, etc. Grain serves as a substitute for such seeds in winter, but if the farmer would sweep up his barn floor more frequently, and throw the sweepings into the hennery for the fowls to pick over, they would greatly relish the treat. It is customary with many poultry breeders, when confining fowls to a limited enclosure, to keep alternate yards sown with something green, such as oats or grass, to supply green food for the fowls, they feeding upon one yard while the other was attaining a sufficient growth for them, to which, when ready, they were turned while the yard previously occupied was again sown for another crop of green food. A liberal supply of gravel, pounded shells, etc., as previously recommended, should always be kept by them.

**Breeding Fowls.**—The first and second year of the hen is the best time for laying, although many hens three or four years old will lay quite well. Hens two years old and over make the best sitters. The tendency of Asiatic fowls is to breed to lighter colors, therefore the males should be as full colored as possible, although discretion and judgment must be used not to have too violent a contrast in the sexes. As a rule, heavily penciled males will get heavily penciled chickens, but if the saddle and neck-hackle are very dark in color, the chicks will be liable to be spotted, but cocks with dark hackles, and hens with lightly penciled hackles will produce rather light penciled chickens. It is commonly supposed that the male bird has most influence upon the color of the chicks, the comb, and many of the fancy points of the breed generally, while the hen influences the form, size, and the useful properties principally.

It is also found with regard to crossing breeds, that the cockerels in the progeny will generally resemble the male parent to a greater or less extent, while the pullets will resemble the hen. In mating birds, the best results are obtained by having both parents as near perfection in form, etc., as possible, but if there are any defects, the defects on one side should, as a rule, be counterbalanced as far as possible by a high degree of excellence on the other, avoiding serious defects. Mr. Wright says: "If it is desired to increase *size*, a cross with a *hen* of foreign breed should be employed, and the same if it be sought to introduce a more prominent breast, or any other peculiarity of shape; but if it is the plumage which is to be modified, it is the *male* bird who should be thrown in. In breeding the cross out again, or in retaining any new characteristic, so as to form a fresh variety, the same rule must be kept in mind.

We believe that much disappointment and uncertainty in the results of crossing has been owing to a neglect or ignorance of this simple principle, and breeding from either sex indifferently. If this be done, the result will often be worthless, and in every case the time consumed will be much greater than is necessary; but if scientifically conducted, we believe crossing would improve many of our older breeds in size, hardihood, and utility, without in any measure detracting from those qualities for which they are valued."

On breeding pullets of the last season's hatch it is better to mate them to adult cocks, and in breeding from hens of a year or two old, young cocks should be chosen; this gives a stronger and more vigorous progeny. Although profitable fowls may be obtained from crossing different breeds, yet we believe it pays better to keep pure breeds of poultry; and in order to keep the breed pure, they must be kept entirely separate from others.

**Incubation.**—It is thought by many of the most successful poultry breeders, that the best results are obtained when the nests are made upon the ground, or where there is a sufficient quantity of earth under the nests to afford a slight moisture for the eggs. Eggs in such nests are more liable to hatch a larger proportion of chicks, and the chicks thus obtained are more apt to show a more vigorous constitution, than those hatched in a dry nest; besides, vermin is less liable to be troublesome in such cases. When making a nest upon the ground,

a small hollow should be scraped in the earth, and a nest box placed over it, to screen it partially from sight, since whether for laying or sitting, a hen naturally likes her nest to be in a partially darkened place, where it will be screened from observation. Soft hay, or straw, cut into two inch lengths should be spread over, and shaped into a very slight hollow, but care should be taken to fill up the corners of the box, so that the eggs may not roll out of the nest, and get into them. When nests are made in boxes, a few shovels full of damp earth should be put into the bottom of the box before putting in the hay or straw in summer, and dry earth or ashes in winter. A little sulphur sprinkled over the earth before putting in the hay, or kerosene oil turned into the corners of the boxes, will also aid in preventing trouble from vermin, and will do no harm to the eggs. The eggs set should be marked with a pencil, so that if another hen should chance to add to the sitter's original number, as is sometimes the case, such eggs may be readily distinguished from the others.

Miss M. H. Reed, of Amenia, N. Y., in an address before the Connecticut Board of Agriculture, gives her method of setting hens, which contains so many useful suggestions, that we give the following extract from it: "In selecting the eggs, we choose the larger and perfect ones, and gather two or three times a day, and keep in a cool place. We have found that the fresher laid eggs hatch in the greatest proportion, — but have often kept them two weeks, or even three, and had good success, but the chances are greatly in favor of those just laid. When two or three hens are fully determined to sit, unless this should occur too early in the season, the sitting-room is prepared for their exclusive use by shutting out the other fowls, and putting it into a perfectly clean and orderly state — it is emptied, swept, garnished. The floor is sprinkled with clean, dry earth, and covered with straw. The nests are made in movable boxes, with soft hay, and placed on the floor in a close row around three sides of the room.

The feeding trough is placed through the middle of the room, and is always supplied with corn. The drinking trough and the dusting box on the unoccupied side of the room, with a small box of gravel, complete the outfit. In here the hens stay until incubation is over, and sometimes fifteen hens live in peace after a few days' quarreling at first. And this is just where the trouble begins; but with proper care the loss from this source is far less than the gain. In the early part of the season eleven eggs are enough for a sitting, and thirteen later when the weather is warmer. The hens are taken in just after dark, and if they have been properly tamed and trained, they will stay where they are put; and even if they do conclude to exchange nests after a few hours, or a few days, it will do no harm, as there are only enough nests with eggs to go round and so all are kept covered. But sometimes it happens that an old hen will not go on at all unless she can have her choice. We put her gently a few times where we want her, and if she will not obey then, we make the other hen give up her place.

Sometimes a giddy young creature will refuse to sit at all unless she can have her nest where she first selected it outside the sitting room, and we find her at all hours of day and night wandering about the room defying authority or persuasion. Such are soon taught better manners by a few days' cooling in an out-door coop in solitary confinement, with only 'bread (wheat) and water.'

At first the hens need close watching at about noon when they all come off to feed; but they soon learn to go wherever they find an unoccupied nest. If others are added to this flock after the first week, more care is necessary to keep them on their own nests, as a hen knows best how long she can safely leave her nest at the different stages of incubation, and to put a hen that has been sitting two days on eggs that have been covered two weeks or more, would almost insure the death from chill of the chick in the shell. For a few days the hen can remain off a long time, but as the twenty-first day draws near her periods of recreation are much shorter, and a sensible hen will not leave her nest after hearing the first peep.

If an egg is broken in any nest and the remaining ones become soiled, they must be carefully washed in warm water, or the coating of egg will stop the pores of the shell, and smother the chick. The nests are examined daily to see if all is right. One restless hen will often cause much trouble in this way. As the season advances and the weather becomes dry, it is best to sprinkle the eggs and hay towards night slightly with warm water twice, — first about the fourteenth day, and again the eighteenth or nineteenth. This softens the shell and so moistens the atmosphere that the lining will not dry upon the chick before it has time to release itself.

If possible, a room full of hens is set at the same time, as it takes little longer to care for twenty than for five. When the chicks begin to hatch, they are removed from the hen as soon as dry, into a basket lined on the bottom with paper, and are covered closely with a woolen cloth, and set by the fire. We once placed fifty in a corn basket and put it by the kitchen stove, and after an hour's absence returned to find the fire increased and the poor things nearly smothered to death. They are kept in the basket two or three days until their mother, or some other hen, is ready to receive them into the coop. They will begin to eat on the second day, and this early handling does much to make them tractable.

The first foe that confronts us is the large brown louse from the hen, which is properly a tick, and fastens itself firmly to the head of the chick; and sometimes a dozen of these giants can be found on one little pate. There they suck the blood until the poor victim grows weak and thin, and perhaps dies of gapes or any other chicken disease that may prevail.

BARREN EGG. FERTILE EGG.

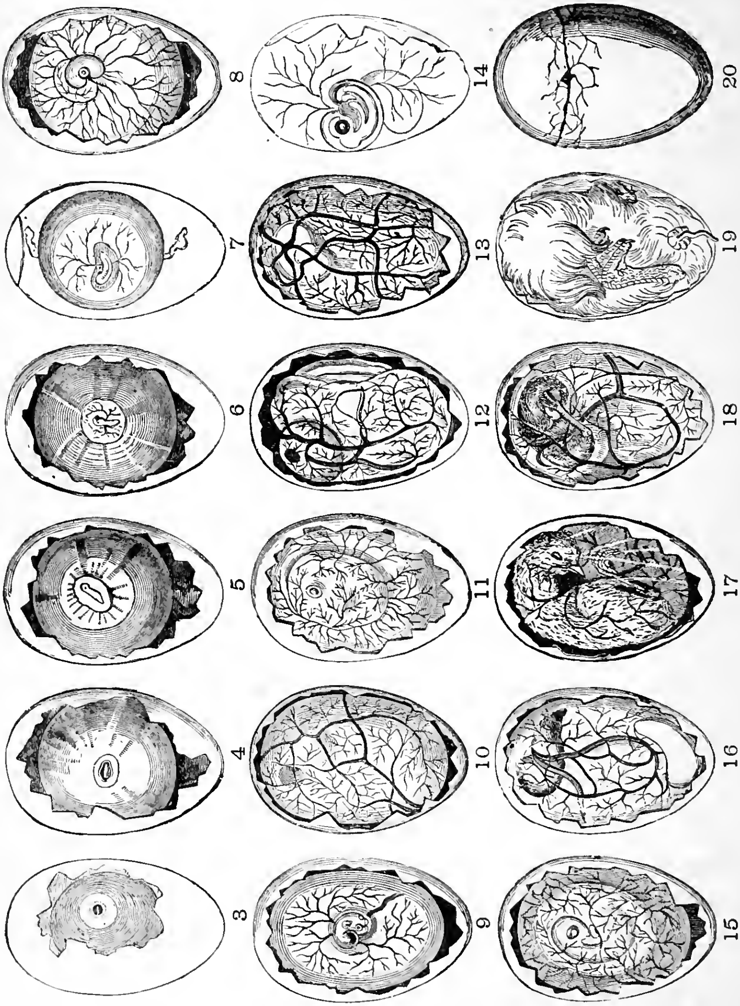
To prevent this, we used the kerosene in the nest boxes; but lest by chance one should appear, we grease the head of each one before putting it again with the hen with a moisture of equal parts of lard and kerosene. An assistant once, intending to make very thorough work, used so much oil that it ran into the eyes, and caused thirty to die of blindness.

The coops are movable, with board bottoms, and are placed each year in a new spot, in the sun early in the season, and in the shade later. Twelve or fourteen chicks are given to each hen, and for a few days she is confined to her coop, but afterwards allowed liberty in the dry part of the day. She has all the corn she will eat as long as she broods the flock, and so keeps fat and warm, and often begins to lay before she weans her family."

An occasional sprinkle of sulphur or Scotch snuff in the nest while the hen is sitting will be a good preventive against vermin. The nest and eggs must be kept *clean*. After the hen has set about ten days, it will be well to sprinkle the eggs and nest with tepid water three times a week. At the eighth or tenth day of sitting, the fertile eggs can be distinguished from those not fertile by holding them up before a strong light; if fertile, the egg will be dark and opaque; if not fertile, it will be merely transparent, as shown in the accompanying cut.

Forty-eight hours from the time of the first breaking of the shell commences is sufficient time for the entire brood to hatch. Where the eggs set were all laid about the same time, the hatching will be quite uniform; but when the eggs vary much in age the time of hatching will vary. When small, light hens are set, or when all the eggs were about the same age, we do not approve of removing the chicks as they hatch from the mother, as they are more

contented with her, and they gain strength by the natural heat of her body; but where there is considerable difference in the time of hatching, the hen would be liable to forsake the nest with her little brood before the eggs were all hatched, if the first hatched were not taken




APPEARANCE OF THE INTERIOR OF FOWLS' EGGS DURING INCUBATION—3D TO 20TH DAY.

from her. Heavy hens, like Brahmas and Cochins, would be liable to step on the chicks in the nest and crush them if they remain with her until all are hatched. In all cases, the shells of the eggs hatched should be removed from the nest every few hours during the time of

hatching, as they fill up the nest, and are also liable to slip over the unhatched eggs, and sometimes prevent their hatching. Handle the hen always with the greatest gentleness and care, as she is easily disturbed and annoyed at such times. It is a good plan to set hens just at night; in such cases the eggs, if fresh when set, will generally begin to break at night or in the afternoon. Towards night remove all the broken shells from the nest, give the hen food and water, and darken her place of sitting so that she will not be liable to come off with her little brood in the morning before it can be ascertained whether all the eggs that will, are hatched.

It will be well on setting a hen, to tack a card to each nest, with the date of the time of setting, the number of eggs set, and chicks hatched. These cards, when preserved, will show how many eggs were set, and chicks hatched during the season. The cuts on the previous page represent the internal condition of eggs that have been taken from under hens at different periods, while being incubated—such as have been sat upon from three and four, up to nineteen and twenty days. Or, commencing with the appearance of the *interior* of fertile eggs (in process of incubation) with the third day, and ending with the condition of such eggs upon the twentieth or twenty-first day, when the shell is naturally cracked, prior to the emerging of the living chicken. The first stages of the embryo are thus exhibited, and the several stages toward the successful hatching of the chick delineated, until ready to break its covering, and emerge alive.

**Period of Incubation of Various Fowls.**—The following table gives the shortest, average, and longest period of time in relation to the incubation of various fowls. Newly

| NAME OF BIRD. | PERIOD OF INCUBATION. | | |
|---|---|---|---|
| | Shortest Period. | Mean Period. | Longest Period. |
| Turkey, sitting on the eggs of the . . . Hen | 17 | 24 | 28 |
| Turkey, sitting on the eggs of the . . . Duck | 24 | 27 | 30 |
| Turkey, sitting on the eggs of the . . . Turkey | 24 | 28 | 31 |
| Hen, sitting on the eggs of the . . . Duck | 26 | 30 | 34 |
| Hen, sitting on the eggs of the . . . Hen | 19 | 21 | 24 |
| Duck, | 28 | 30 | 32 |
| Goose, | 27 | 30 | 33 |
| Guinea Hen, | 24 | 26 | 30 |
| Partridge, | 22 | 24 | 27 |
| Pheasant, | 23 | 25 | 27 |
| Pea Fowl, | 26 | 28 | 31 |
| Pigeon, | 16 | 18 | 20 |

laid eggs will always hatch earlier than stale eggs, while the degree of temperature in the body of the sitter will also make some difference in the period of incubation. Chickens, on the average, will break the shell at the end of the twenty-first day. If proper care has been taken to preserve moisture during the period of incubation no assistance will be needed. To disturb the hen more than to take the chicks out of the nest as fast as they hatch and are dried off, does more harm than good. When the shell has been chipped for some time, with no farther progress made, the chick may be helped a little by gently cracking the shell all around, without tearing the membrane that lies underneath. If that be torn, the fluid will be apt to dry and glue the chick to the shell. We have sometimes assisted chicks from the shell when the membrane has thus become torn and dried on, and had them live; but generally they will be weak and soon die. If blood oozes from the membrane in the operation, there will be but little hope of success.

**Sex of Eggs.**—Many experiments have been tried, and much written upon determining the sex of the future chick by the appearance of the egg. The theory entertained in the

time as ancient as Horace, was, that long eggs would produce cocks, and those of a rounder form, pullets. Another ancient author, Columella, also advances the same theory. This theory is also entertained by poultry breeders of the present day. Others affirm that the sex can be determined by the position of the air cell in the egg. The exact location of the air cell can usually be determined, by going into a darkened room and holding the egg between the eyes and the light. It will be found in many different positions, sometimes at the end of the egg, near the large end, and at the side, or midway between the end and side. It is thought by many, that if the air cell lies at the end of the egg, a cock will be produced, while if it lies at the side, a pullet will be the result. If an egg is full, or has no air cell whatever, it should not be used for sitting, as such eggs will not hatch. It has been found, by many experiments, that the early eggs of pullets will produce a larger proportion of cocks than pullets.

No rule has yet been determined as strictly reliable, but we are inclined to the opinion that when a large proportion of pullets are desired, the oval, rather than the long eggs should be chosen for setting, and such as have the air cell at or near the side; while if a majority of cocks are preferred, the large eggs having the air cell at the large end should be selected. One poultry breeder says: "Out of the hatchings of three hens, the percentage of pullets from eggs with the spot on the side near the end, was about nine-tenths of the number living."

Another extensive breeder gives the result of his experience as follows: "First sittings, —Eggs taken as they come from the nest; fifty-three chickens, gave twenty-eight cocks and twenty-five pullets. Second trial.—Eggs picked with the air sack more on the side than on the end. Result, thirty-five chicks—twenty-four pullets, eleven cocks. Third trial.—Eggs picked with great care, the position of the air sack marked with a pencil by lamp-light, and none set but those that had the air sack well past the center of the top of the egg. Result, thirty-one chickens—twenty-seven pullets, four cocks. Fourth trial.—Eggs picked with the air sack on the top of the egg. Result, sixteen chickens—fourteen cocks, two pullets. Fifth trial.—Eggs taken as they come from the nest. Result, thirty-eight chickens—seventeen cocks, twenty-one pullets. My breeding stock were White Leghorns. Hens, two years old; cocks, ten months. Another fact I wish to mention. The cocks from the eggs with the sack on the side were all lop-combed, feminine-looking, not one fit to breed from; while the fourteen eggs with the air-sack on the top were all fine, well-shaped birds. In examining the eggs, I find there are nearly one-third where it is impossible to determine the air bubble, being neither on the top or sides, but about half way between. Those I discarded."

Although the above rule may not prove strictly reliable in every case, other conditions having a modifying influence to a certain extent, yet we believe it to be the most reliable that has ever been adopted.

**Care of Chickens.**—Chickens require no food whatever for twenty-four hours after hatching, as there is sufficient nutriment in the egg to sustain them for a time. When taken from the nest as soon as hatched, they should be put in a warm place in a basket in which is a sufficient supply of cotton, wool, flannel, or other warm, soft material to put under and cover them, until the whole brood is hatched. Care should be used not to cover them too closely, or put them where the heat will be so great as to smother them. Young chickens are very tender, and consequently are sensitive to either too much cold or heat. We have known of large numbers being killed by having the basket containing them thoughtlessly put under or too near a hot stove. Never remove the little horny scale seen at the end of every young chicken's bill, as is the stupid custom with many ignorant persons. Their beaks are very soft and tender, and would be liable to be injured by such harsh treatment.

The first meal should be hard-boiled egg, chopped fine; this should be continued three or four days. Always give the hen all she will eat of wheat, corn, or meal mush; give her

also all the water she will drink. The chickens should have water kept by them, but never be forced to either eat or drink. They will follow their own natural instinct, and eat and drink when they require nourishment, if the food and drink are provided for them. Loppered milk should also be given them. A little meat, cooked and chopped fine, should be given once a day. Insect food is a part of their natural diet, and chickens fed with a little meat will have more constitution and grow and fatten more rapidly than if deprived of it. Sheep's pluck, refuse meat from the butcher, such as the lights of beef, make excellent food when boiled tender and chopped. Rough tallow, chopped fine, and drippings from meat are also good to mix with scalded corn meal as the chicks get older. Skimmed milk is better than water to mix with the corn meal. Cracked corn, or wheat screenings, scalded, come next in order, and may be given when the chickens are old enough to digest it. A pailful of corn or wheat should be covered with boiling water in which a large tablespoonful of salt has been dissolved and left to stand covered until it is cold. Cayenne pepper should be added if the weather is cold or wet. Rice is also an excellent diet for chickens. An inferior quality known to the trade as "broken rice" is just as good for this purpose, and it requires so little for food that the expense is not much greater in the Northern States than corn-meal, while at the South it will be the cheapest feed known.

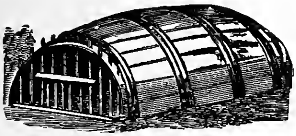


FIG. 1. BARREL COOP.

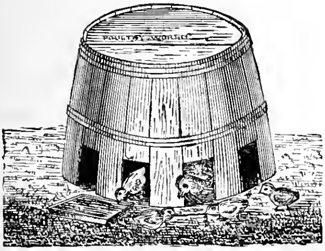


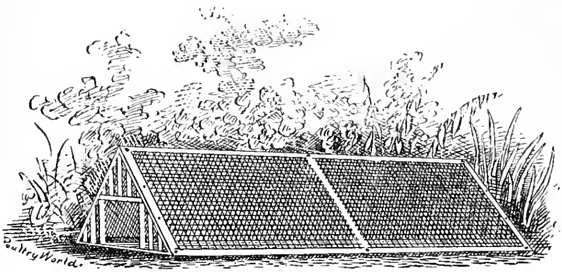
FIG. 2. BARREL COOP.

FIG. 3. BARREL COOP.

It should be cooked or soaked before feeding. During the first week, every two hours during the day will not be too often to feed chickens. Feed them all they will eat at each time, but do not leave any to become sour, or to be mixed with dirt and afterwards eaten. Chickens will never thrive unless they have a supply of clean, fresh food. From one to two months old, once in three hours, is none too often to feed; after that, three or four times a day is sufficient.

Chickens should also have green food. If there is no grass plot for them to run upon, give them cabbage or lettuce leaves cut in fine shreds. When the hen has hatched her brood, and is ready to be taken from the nest, she should be placed in a coop where it will have a southern exposure, so that the chickens can have the benefit of the sunlight. Never permit them to be exposed to the wet and cold. Coops of almost every pattern may be designed,

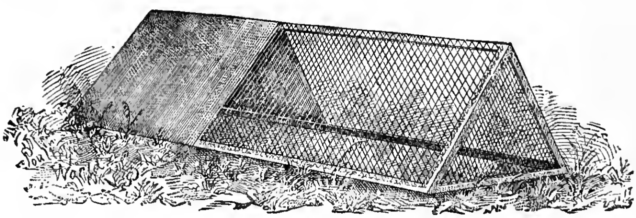
according to the ingenuity of the maker. A coop with a covered wire run that may be moved at pleasure is very convenient for protecting young chickens when cats and rats are troublesome. Such coops afford a complete protection for the chickens, while they can be moved to fresh ground as often as desired. A very good temporary coop can be made from an old barrel, by knocking out one end and putting slats in front. An opening should be made at the other end sufficiently large for ventilating purposes, and where it will be near the top of the coop when ready for use. Very good coops may be made from barrels, as represented by the Figures, 1, 2, and 3.




COVERED RUN FOR CHICKENS.

In order to prevent the old fowls and half-grown chickens from eating the choice bits of food from the little ones, some kind of coop should be devised into which the latter alone can enter. Large box coops with slated tops of lath, raised upon blocks of a sufficient height to allow the little ones to run under and exclude the larger ones, are good for this purpose. The food should always be put upon a clean surface, and never upon the sand or soil.

**Incubators.** — Hatching eggs by artificial means was practiced by the Egyptians and Chinese successfully thousands of years ago, and is also at present; yet, in Europe and this country the practice is comparatively a recent one, and is not as well understood as it probably will be in the future, although very good results have been obtained at the present stage of experimenting, those having attained the highest success that have followed nature most closely.

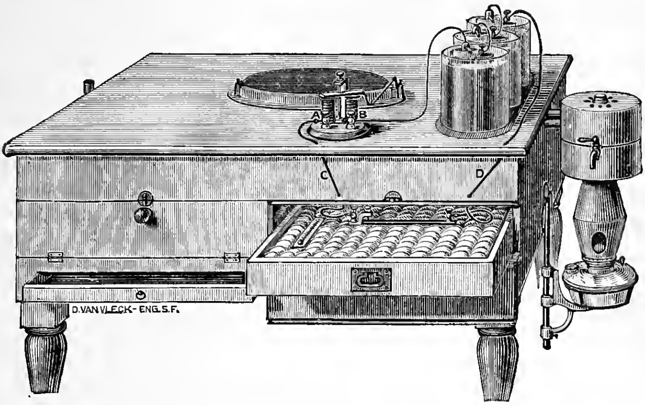


COOP WITH COVERED RUN.

Reaumer was the first who attempted in a systematic and earnest manner to hatch chickens by heat artificially applied. His method was to place the eggs in a wooden cask, and then surround it with fresh manure from the barn yard in a state of fermentation, which was renewed as frequently as necessary to keep the proper degree of temperature. This method, undesirable as it is, was employed for a considerable time, and quite successfully in France. Cantelo was the first who devised the method of supplying the heat from above, in imitation of the hen. Various kinds of incubators have since been invented, some of which were attended with so much care and labor in management, that although they would hatch a large proportion of the eggs, their use could not be regarded as profitable. Within a few

years past considerable improvement has been made in incubators, until we have them now that are so simple in construction, that they can be successfully managed with comparatively little labor and expense.

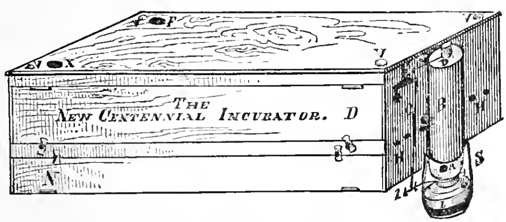
An incubator that will hatch from seventy to seventy-five per cent. of the eggs, may be considered a good one. As with the hen, the fresher the eggs, the better they will hatch. Eggs that are over a week old, will, as a general rule, hatch very poorly by artificial heat.




ECLIPSE INCUBATOR.

With the hen, there is considerable loss by eggs broken in the nest, and nests deserted from one cause or another. Again, the eggs of different breeds of poultry vary greatly in fertility, while the eggs of the same breeds will also vary much in this respect.

In the Eclipse Incubator, manufactured by E. A. Samuels, of Waltham, Mass., the heat is radiated from a tank which is so contrived that there is a uniform circulation of hot water through it, and is applied to the *top* of the eggs in imitation of heat from the hen. The eggs are placed in drawers, the bottom of which consist of wire netting. Beneath the drawers is a series of ventilating pipes, which conduct to the bottom of the eggs a full supply of cool, damp air. The water in the tank is heated by a kerosene oil lamp, which consumes only about a quart of oil in twenty-four hours. The lamp burns beneath a small boiler which connects with the tank, as illustrated in the above cut. By no possibility can the fumes of the lamp enter the incubator or reach the eggs.

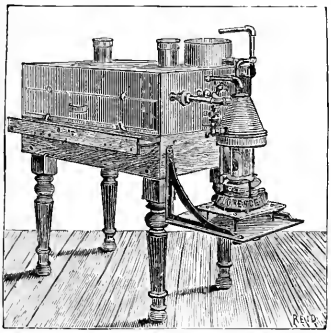



THE NEW CENTENNIAL INCUBATOR.

B. Boiler. C. Connecting Rod. D. Door of Egg Chamber. X. Tube through which Tank is filled. H. Ventilator to Nursery. I. Lamp Lever K. Outside Lever of Rock Shaft. L. Lamp. N. Door of Nursery. S. Springs which hold lamp in place. V. Ventilator flues from Egg Chamber.

The New Centennial Incubator, manufactured by A. M. Halsted of Rye, N. Y., is in two parts; an inner case of galvanized sheet iron, covered by an outer casing of wood; with a dead air space between the two cases. It has double doors — an inner and outer one — the inner one being provided with a glass window through which to examine the thermometer and the eggs. There is no electricity, no clock-work, no weights, pulleys, or double levers. A simple rock-shaft passes through the side of the machine, with a lever on each end of the shaft; one of which is connected with the regulator, and the other with the lamp. A simple thumb-screw in the back of the machine, on the outside, adjusts the regulator to any required degree of heat.

The regulator is placed above the eggs, out of the reach of the young chicks. It is sensitive to the least change of heat, and very powerful; and instead of changing the flame from one extreme to the other — either very high or very low — as is the case in all other machines, it regulates the lamp to give the required heat. The action is regular and graduated to the needs of the machine: if in a very warm room, a low flame is produced: if the room grows colder the flame increases; and if the temperature of the room continues to fall, the flame grows larger until the full power of the lamp is turned on.



RELIANCE INCUBATOR.

Ventilation is provided for, by taking in a current of pure air, which passing close to the tank, is heated before it comes in contact with the eggs. It is then drawn to the four corners of the egg chamber, and thence carried by tubes outside of the machine. By this device the sides of the egg chamber receive the same amount of heat as the centre, and there are no cold corners. The moisture or evaporating pan is so placed that it receives a gentle heat from the return flue, and thus supplies a moderate amount of vapor constantly under the eggs.

In the Reliance Incubator, by James Dennis, East Providence, Rhode Island, a soapstone radiator, which is heated by hot water pipes imbedded in it, is used for heating instead a hot water tank.

There are several incubators of greater or less merit now in use in this country. Mons. Boucheraux, a French writer who has experimented quite extensively in hatching chickens by artificial means, gives the results of his investigations, which have been translated from the *Monthly Bulletin*, a French journal of the Society of Acclimation, as follows: "Having tried several kinds of artificial hatchers, I have quite frequently noticed that many of the young die in the shell at the end of the sixteenth, seventeenth, and eighteenth days, and that the greater part of those that survive until the twenty-first day, would die at the time of hatching. Perhaps, they were not sufficiently strong, or it may have been that the pellicle which envelopes them became so dry that it was impossible for the young chick to come out of his prison. In order to furnish more moisture I made, some two or three years since, a new artificial sitter, the hot water receptacle of which is made of *terra cotta* enameled on the inside; this allows a sufficient quantity of moisture to transpire on account of its porosity. I have, with this arrangement, obtained much better results. The hatching gave a much larger per cent., and I observed that the pellicle, of which I spoke just now, was exactly similar to that of eggs hatched under the hen. But in spite of the success obtained by this method, I have not as yet found a wonder, for I find it impossible to preserve for more than ten or twelve days the chicks hatched in this manner. One of my friends, whom I had make an autopsy for me, found

that they all had diseased lungs, and were afflicted in the same manner as those which have several times been submitted to the experience of the pneumatic machine I therefore concluded that there was a failure of air; indeed my incubator was so air-tight that there was no loss of heat, and even my opening the door twice a day did not suffice. At last, after groping first here and then there, I constructed an incubator which, I believe, unites all the required conditions.

This incubator consists of a rectangular wooden case about forty inches in length, twenty inches high, and about thirty inches wide. This fits upon a wooden bottom, supported by two hooks, to enable it to be readily taken apart for cleansing purposes. In this case a reservoir of zinc is placed horizontally (the capacity of this reservoir being about eighteen gallons), which divides the case into two compartments. This reservoir is filled and emptied by a system analogous to that of other incubators. The water in the reservoir is kept at a constant temperature by two gas burners, which enter into the boilers and traverse the reservoir from side to side. A collecting pipe distributes the gas in the burners, and is provided with a mercurial regulator placed on the inside. This regulator is nothing more than a strong thermometer with a hole in its side, through which the gas passes to its destination. This hole is opposite the 102° mark.

The opening giving passage to the gas finds itself entirely stopped when the temperature reaches the desired height. The mercury forms an obturator, and regulates the heat to one-tenth of a degree, nearly. It is indeed completely impossible, without regulating anew this thermometer, to raise the heat beyond the necessary point. With this regulator there is no pressure nor change of heat in the gas. In the absence of gas two small lamps with a flame capable of being regulated; a hole is made in these burners and the products of combustion escape by means of two openings behind the apparatus. In order to give the eggs the amount of moisture necessary for incubation, there are two small holes with funnels soldered around them, and with movable plugs, which permit the steam from the water in the reservoir to spread itself in the egg chamber and keep there an atmosphere always moist. Over the reservoir are two air tubes pierced with small holes (.035 inch in diameter), the one coming in at the right side and going over to the left; and the other coming in on the left, and going over the right side, carrying the fresh air over the eggs and removing the carbonic acid gas.

The air, in thus entering, becomes warm in its whole course over the reservoir, and does not chill the eggs. The air is thus in the same condition as that which has passed through the feathers of the natural mother. About two inches above these tubes we find a screen coming to about an inch from the side of the case (the same space being left in the middle). This screen is composed of three layers, the bottom one of zinc, then one of wood, and the third of swan down, with a little cut straw thrown over this top layer. The eggs are placed upon this bed, and the zinc below, being highly polished, permits the heat to glide along the surface and pass through by the opening in the middle of the screen, and those between the screen and sides of the case to become stored up in the chambers. The heat is stopped above by two glass plates with a stratum of air between them, and redescends upon the eggs, causing the last ones to be heated from above, although they are placed over the reservoir.

I have thus been able to leave chickens in the hatching chamber for twenty-four hours after hatching, without any injury whatever, after their successful *entrée* into the world. The chamber below, being furnished with air in the same manner as the one above, serves as an artificial mother. A small door made in front gives the liberty of ingress and egress to a rearing door; a door placed behind permits one to have an eye upon them. This incubator being closed above by two superimposed panes of glass, renders the different phases of hatching visible to everyone. To sum up the advantages, we find:

1. It is absolutely impossible to give the eggs more heat than is necessary for them.

2. A regulator permitting you to modify this heat in proportion as the embryo increases its vitality.

3. Moisture necessary for incubation and much or little as desired at the time of hatching.

4. Constant and natural supply of pure air, to promote general good health. Indeed, most all of the inconveniences of artificial incubation are avoided by this apparatus.

Having once placed the incubator in a position well sheltered from atmospheric changes, firmly fixed and on a level, take care to have it filled with warm water. Should the incubator have a gas attachment it will be necessary to allow this to pass through the regulator, and to open the other cock only when an accident or the absence of the gas has occasioned too much cooling, and never to leave this cock open without observing scrupulously the temperature inside the incubator, for it would be very easy to bring mortification to the operator. If the incubator has a lamp attachment, it is necessary to note well that this is only for the purpose of preventing the water from cooling too quickly, and that the 102° to 104° should be attained only by the addition of boiling water. One or two days should suffice to regulate this apparatus.

Before placing the eggs on the frames these latter should be covered with a thin layer of wool in such a manner that the heat does not come altogether on the under side. The glass cover of the incubator should also be covered with a bit of cloth or linen to darken the interior. The thermometer should be placed upon the eggs. The gutty eggs should be taken out of the incubator, as well as those marked with grayish blue spots, by which the air comes too quickly to the interior.

The eggs should be turned morning and evening without shaking; in fact, they must be handled very delicately. Those on the side should be placed in the center, or in some place other than that they previously occupied, so that during incubation they will occupy all the parts, more or less warm, of the apparatus. It is also a very good plan to procure a small greasy feather from the breast of a Cochin China, if possible, and with this to touch lightly the surface of the eggs before returning them. This procedure will procure for them a small quantity of that grease which gives to them the brilliancy which they obtain during incubation under the hen, and which softens the shell so nicely.

It is necessary to always take care to replace the warm water and obtain the proper degree before returning the eggs. If you do not wish to be exposed to the chagrin of a failure, it is prudent to open the doors only in the morning and evening, when the eggs are being turned.

On the twentieth day it is necessary to be very careful in turning the eggs when they are propped upon the side. The chicken at this time having made an evolution in such a manner as to bring his head to the air, we expose him in this case to the necessity of again making another turn, to the labor of which they most always succumb. It is a matter of great importance to diffuse as much moisture as possible in the incubator, either by placing small jars of water in the incubator, or by sprinkling it upon the wool. This water should be lukewarm, not cold. It is also necessary to take care not to put the eggs in warm water to see if the young chicks stir, for these eggs, not having the shell greased as those covered by the hen, will absorb too much water and the chick will surely die.

Incubation by means of the artificial incubator should be conducted for twenty-one days at a temperature of 102° to 104°. This heat should be maintained for ten out of twelve hours, if we wish to have much success. If it should descend to 50° or 54° at the time of turning the eggs, there will be no inconvenience, provided it returns within twenty minutes to 86° or 95°, and a few minutes afterwards to 102° or 104°, remaining at this temperature for at least ten hours, as above stated. This is why we should not open the doors between the regular times for turning, except in case of accident. If, owing to some outside influence, change of temperature or other, the heat of the incubator should rise to 109½°, we need not disturb ourselves, provided it lasts no longer than two or three hours. In this case

we should open everything and turn the eggs, although they had been previously turned that morning. Likewise, if by one cause or another, perhaps forgetfulness, the incubator has been left without heat and the eggs become completely cold, there is no occasion to be at all uneasy. The eggs can remain in this state for thirty-six and even forty hours with only this inconvenience, that the period of incubation will be prolonged just as many hours as it has been interrupted.

We should not assist a chicken to come out of the shell when even this operation has lasted for ten or twelve hours. The efforts that it makes are necessary for the absorption of the yolk and the umbilical cord. When the chicks are hatched, they should remain ten or twelve hours in the incubator, and that without eating. At the end of this time they should be placed in the compartment below, having previously covered the floor of it with bran or an old bit of carpet.

**Proper Temperature for Incubators.** — The degree of heat necessary for hatching eggs by artificial means is from 102 to 104 degrees. Reaumer, Vallee, Wortley, Schroeder, Brinley, Wren, Boyle, and other French and English incubator inventors, advise that the heat should be less at the beginning of the incubating process than at the more advanced stage; hence, at the commencement it should be about 102°, and gradually increased to 104°, as the incubation progressed. Mr. Wren states that in his experiments in determining the proper degree of temperature, he placed four eggs in the incubator and submitted them to a heat of 102° at first, increasing to 104° at the last. The result was that three out of the four eggs hatched and did well; while of another batch of eggs where the temperature was reduced, they failed altogether, none of the chicks having properly absorbed the yolk for want of sufficient heat.

He also says: "In this I feel sure we are imitating Nature, because a hen, when she first commences to sit, has feathers between her body and the eggs, which are non-conductors of heat. By the friction of the eggs these wear off, and her body comes in direct contact with the eggs; therefore the heat must, if any difference, be rather greater at the latter part of the time."

**Turning the Eggs.** — In proof of the necessity of the occasional turning of the eggs during the incubating process, the same author says: "I have examined the eggs under a *sitting hen*, and made the following memoranda of the position of the eggs during a part of one day. At 10.30 A. M. marked four eggs, and left them in the center of the nest; at 1.30 P. M. three of the marked eggs were moved to the outside. Marked three more, and left them in the middle; at 2.45 P. M. the three marked last were moved to the outside. Marked four more and left them in the middle; at 4 P. M. the four marked last were on the outside, and some of those marked first were back again in the middle of the nest."

Mr. A. M. Halsted, of Rye, New York, says on this point: "I have several times carried eggs through the whole three weeks in the incubator, without turning or moving them at all. Unless some accident interfered, there were some which hatched — generally about thirty per cent.; others which pipped the shell, but had not strength enough to get out; and still others, dead, with the yolk sack not fully absorbed, and dried fast to the bottom of the shell; of those which did hatch, most were weakly, and fully one-half died before they were a week old. One lot which I turned twice a week did ten or fifteen per cent. better. Another, which was turned daily, hatched seventy per cent.; and a final test when I turned the eggs *twice* daily, I obtained fifty-eight strong, healthy chickens out of sixty fertile eggs, and both the remaining eggs had fully developed chickens in them.

Hence, I adopted the practice of turning twice daily, — morning and night. Further experiment — turning them three and four times a day, have not given any better results than this."

**Management of Incubators.**—The following directions for the practical management of incubators are given by Mr. Halsted, to whom previous reference has been made: "Comparatively few are successful in the use of incubators, and many really good machines have been thrown aside and pronounced worthless, when all the trouble has been want of management. First of all it is necessary to thoroughly *test* the incubator. Do not fill the boiler and tank too full; allow for the expansion of the water under heat, remembering that it increases nearly a ninth part in bulk from 32° to 212° Fahr. Test the working of the regulator and ventilators; increase the heat up to 130°, if a new machine, and then decrease it to 100°. Again increase to 103° (the proper heat), and strive to keep it at that temperature. The *range* is from 100° to 105°, neither above nor below these points except perhaps transiently. So soon as you have accomplished this result, you may put your eggs in, not before. The eggs, to insure success, *must be* fresh, not over *three* days old.

A LIFE BOAT.

During the first forty-eight hours, I take the eggs out and cool them for five to ten minutes at least six times, and every six hours is better. If a gentle moisture is maintained in the egg drawer they will need no other application, but if a dry heat, it will be well to sprinkle them with tepid water when airing. The eggs should also be turned as often as twice in twenty-four hours, and oftener would be better. Do *not* during the first six days allow the heat to get *above* 103°. I would far prefer to run it at 102 than risk any chance of its exceeding the former point. During the second forty-eight hours decrease the periods of airing, but increase the time to fifteen minutes. The eggs are supposed to be aired in a room where the temperature is not *under* 55°. During the third forty-eight hours, air twice a day and turn the eggs at each airing. When turning the eggs it is better to change their position also, shifting those in the middle of the drawer to the outer edge. Do not be afraid of handling the eggs. So long as they are not shaken or jarred, there is no danger of their being injured.

At the end of this period (six days), examine the eggs by candle or lamp light.

Partially close the left hand, letting the thumb and forefinger lap; hold the egg between the thumb and two first fingers of the right, *under* the fingers of the left, and turn slowly between the eyes and the light. If it is perfectly clear, lay it aside; it is not fertile; and will not hatch. Fertile eggs will show a dark spot on one side, appearing greater or less as turned on either side of the line of vision. At this stage the progress of incubation varies very much, some eggs appearing half opaque and others with only a discernible spot. The novice must expect to sacrifice some eggs in acquiring this knack, and to that end it were better to put in twenty or twenty-five eggs expressly for experimenting upon.

This is the most precarious time during the whole process of incubation—the fifth, sixth, and seventh days. At this stage a heat of 106° will sometimes spoil a whole batch of eggs: while on the seventeenth day I have *held the heat at* 115° *for over two hours*, and yet hatched out seventeen chickens from twenty eggs. All fluctuation must be avoided if possible; the heat should be steady at 102° to 103°; the eggs aired twice a day, from fifteen to twenty minutes each time; and a slight but perceptible moisture maintained in the drawer. A *dry* heat is much more difficult to regulate, and much more dangerous to the life of the unhatched chick.

After the seventh day a little more latitude may be allowed in the temperature without fatal results, but I would not be understood as *advising* it until after the tenth day, at which time the heat should be slightly increased, say to 102° to $103\frac{1}{2}$°. From this time forth air the eggs once a day, leaving them exposed from twenty minutes to half an hour. During this period the moisture may be kept up, and if anything slightly increased; the object being now to keep the little prisoner in a healthy growing state, which cannot be done *without* moisture. Very many persons fail at the eleventh hour—the eighteenth or nineteenth day —from this cause. I will mention one case in illustration:—A gentleman living some eight miles from me, after seeing my incubator, constructed one himself from ideas of his own. It was made to hatch chickens on a large scale, holding about 1,000 eggs. He started with 500 eggs, and everything progressed finely until about the sixteenth day; at that time he called on me and stated how he was getting along, saying that he thought my practice of keeping a constant moisture *under* the eggs was a fallacy.

He had commenced with it, but after the first week had given it up as too much trouble. I cautioned him about the result, but he expressed so much confidence, said he had broken several eggs that morning, and all contained live chicks, that I concluded there was perhaps a show for success, and so told him. But on the twenty-second day he visited me again: he had not hatched a single chicken; all were dead in the shell, and all seemed to be full formed. A few of the eggs were pipped, but the outer skin was as dry and tough as a piece of parchment, and the poor chick was as hopelessly immured as if it had been enclosed in sheet iron. He was positive that the heat had not exceeded 104° nor been less than 100°; so the failure was attributed to no other cause (apparently) than lack of moisture. I can cite a number of just such instances which have come to my notice, and in all of them the failure was due to the same cause.

One of the most essential requisites for success is *cleanliness.* One bad egg in the drawer will sometimes spoil every one in its vicinity during the second week of incubation; after that there is not so much danger. It will frequently happen that eggs will upon first examination be passed as fertile and yet prove bad. After the tenth or twelfth day examine the eggs closely every day, and if any exudation in the shape of drops of fluid or gummy matter be discovered on the eggs, removed the affected one at once. To show the variation of temperature the eggs will bear during the third week, I will give my experience at the fair of the American Institute, held at Empire Rink, New York City, in September and October, 1870. The place assigned me was on the north side of a room some 300 to 500 feet in size, and within about twenty feet of the receiving door. It was a great risk to attempt to hatch chickens in such an exposed place, but I accomplished it.

Night after night the heat would fall to 95°, and in one instance it went to 89°. It was impossible to keep the heat up, although the incubator was covered and completely enclosed with heavy woolen blankets. Only four times did the heat get to 104°, usually reaching 102° by sixr or seven P.M., and then falling to 96° or lower during the night. The incubator was left at ten P.M., and not visited again until seven A.M. (This would be always my custom with any good self-regulating machine.) The eggs in this case were kept in my incubator at home until the twelfth day, and then taken to New York to the fair, a distance of twenty-five miles by rail. I averaged about *fifty per cent.* in hatching on that occasion, and taking into consideration the constant fluctuation of temperature, this was unusually good success. For moving the eggs from one incubator to the other, I constructed a box, lining it with felt, and placing in the bottom a tank of hot water; then placing the eggs between several thicknesses of woolen blankets and closing the box tight. In one case, where a few eggs had been overlooked and left in the home machine until the twentieth day, I started from home with two of the eggs pipped; on my arrival at the rink, I found one of the chicks out and entirely free from the shell.

I have been led by slow degrees to adopt the opinion that the great drawback to artificial incubation was the difficulty in getting through the first ten days. I noticed some years since that when a hen left her nest, and the eggs were fairly chilled, during the *early* stages of incubation, she rarely brought out any chicks, and usually those that did come forth were weakly, and pined away a few days or weeks of existence, and then dropped off; also, that even when eggs had been left for fully twenty-four hours during the latter days, they often hatched out well and strong. In support of this view, one of my neighbors, a perfectly reliable gentleman, gave me a remarkable instance. He had a large number of turkey eggs set under common hens; under one of the hens were some of her own kind, probably laid to her by one of the fowls roaming over the place (they not being confined in a sitting-room). These hen's eggs hatched, and the mother left the nest with two chicks, leaving ten turkey eggs about twenty-three or twenty-four days incubated.

When found the eggs were cold and supposed spoiled; no further notice was therefore taken of them until two or three days after, when a hen was found to have taken possession of the nest and assumed the duties of incubation. Some days after, to the surprise of all, she came off with seven turkey chicks, all strong and well. This was in June, warm weather. Since then I have experimented with eggs, and have demonstrated to my own satisfaction that eggs can be, at certain stages of incubation, deprived of heat for twenty-four to *seventy-two hours*, and yet be hatched! In fowls this period would seem to be between the sixteenth and seventeenth days; in turkeys, the twenty-first to twenty-third days, perhaps even later. The exact time I have been as yet unable to determine.

My experience with this led me to try placing the eggs under hens during the first few days of incubation. I have found even three days under hens before placing in the incubator a great benefit, but seven to ten days is much better, and one reason I believe to be the following:—If my reader will notice an egg after having been under the hen for a few days, he will observe it to have a *polished* appearance, as if *oiled* and *rubbed.* There seems to be some oily secretion on the feathers or on the body of the hen, which, with her action in moving the eggs, produces this appearance. Eggs thus treated seem to retain the moisture or watery portion of the contents much longer than perfectly fresh ones; hence it would seem that the 'greased appearance' prevented or rather retarded evaporation. An egg placed at first in the incubator and left there the same length has not this appearance, being as fresh to all outward seeming as if just laid. To establish this fact of evaporation, I took eggs of equal weight and placed some under hens and the rest in the incubator, subjecting the latter to a dry heat. At the end of three days there was a discernible difference, and at seven days a very marked difference in weight; at ten days there was *over half an ounce* difference in

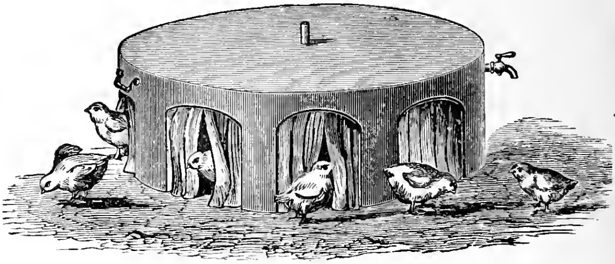
their respective weights. It is in consequence of these discoveries that I so strongly recommend the constant application of moisture during artificial incubation; and knowing how easy it is for a novice to overdo or come short in the matter, I recommend the use of hens for the first seven to ten days.

It would be very easy to give a page or more of directions 'how to manage an incubator,' but all the written directions in the world will not give some men success. Nothing but experience, and that bought with many failures, will teach them the *little* attentions necessary to ensure success. I have striven to give these plainly, and if any of my readers are benefited by it my labor will not be lost. I add a table of record of daily temperature and remarks as jotted down by me during a few weeks of successful operation."

## REGISTER OF INCUBATOR.

| Date. | Mercury. | | | | | Remarks. |
|---|---|---|---|---|---|---|
| | 6 A.M. | 12 N. | 6 P.M. | 10 P.M. | Open Air. 6 A.M. | |
| 1869. April 13 | — | — | — | — | — | Started heat in incubator at 1 P.M. At 10 P.M. mercury marked 115°. Turned down lamp. |
| " 14 | 98° | 104° | 102° | 100° | 38° | |
| " 15 | 97 | 101 | 102 | 104 | 40 | Small leak under tank. Put in half an ounce of Indian meal. |
| " 16 | 100 | 101 | 104 | 102 | 37 | Leak stopped. Lamp burning evenly. Trimmed twice. |
| " 17 | 101 | 103 | 103 | 102 | 40 | Put in twenty eggs. |
| " 18 | 101 | 102 | 103 | 103 | 42 | |
| " 19 | 102 | 102 | 103 | 102 | 38 | Raw cold day. Wind east. Turned eggs three times. |
| " 20 | 101 | 102 | 102 | 101 | 41 | Filled lamp. Trimmed twice daily. Turned eggs three times. |
| " 21 | 100 | 102 | 102 | 102 | 43 | |
| " 22 | 101 | 101 | 101 | 102 | 42 | Put in twenty-two eggs. |
| " 23 | 102 | 103 | 103 | 102 | 45 | Examined first lot of eggs; found five unfertile. |
| " 24 | 100 | 102 | 103 | 102 | 44 | Turned first eggs only twice daily. |
| " 25 | 101 | 102 | 102 | 102 | 51 | Replenished water in egg-drawer. |
| " 26 | 102 | 102 | 103 | 103 | 48 | Put in twenty-six eggs. Refilled lamp. |
| " 27 | 100 | 101 | 102 | 102 | 42 | Changed blanket under eggs. |
| " 28 | 101 | 102 | 103 | 103 | 48 | Examined second lot of eggs. Three unfertile. Turned two. |
| " 29 | 100 | 102 | 102 | 102 | 40 | |
| " 30 | 101 | 103 | 103 | 103 | 46 | Found one bad egg in remainder of first lot. |
| May 1 | 102 | 103 | 102 | 103 | 50 | Put in fifteen more eggs. |
| " 2 | 103 | 103 | 103 | 104 | 55 | Examined third lot of eggs. Four bad. Changed blanket under eggs. Refilled lamp. |
| " 3 | 102 | — | — | 102 | 51 | Absent from home. Examined third lot in evening. Four bad. |
| " 4 | 102 | 103 | 103 | 103 | 48 | Replenished water in egg-drawer. |
| " 5 | 102 | 103 | 103 | 102 | 47 | Put in thirty more eggs. |
| " 6 | 101 | 102 | 103 | 103 | 52 | Changed blanket. |
| " 7 | 102 | 102 | 103 | 102 | 51 | Two eggs pipped at 12 noon. Both out at 6 P.M. Three more pipped. |
| " 8 | 102 | 103 | 103 | 103 | 54 | Thirteen chicks from first lot, and one dead in shell. Refilled lamp. Examined fourth lot of eggs. One bad. |
| " 9 | 101 | 102 | 102 | 103 | 52 | |
| " 10 | 102 | 103 | 103 | 102 | 50 | Examined fifth lot of eggs. Three bad. |
| " 11 | 102 | 103 | 103 | 103 | 55 | 10 P.M. three eggs pipped. |
| " 12 | 101 | 102 | 103 | 104 | 51 | 6 A.M. five chicks out, eight more pipped, and all out during day. |
| " 13 | 102 | 103 | 103 | 103 | 57 | Four more chicks out, seventeen in all. Two eggs bad. Put in twenty more eggs. |
| " 14 | 102 | 103 | 104 | 103 | 60 | Refilled lamp. Changed blanket. |
| " 15 | 101 | 103 | 102 | 101 | 57 | Bad egg broke in drawer. Took everything out, changed blanket and water, washing eggs in tepid water. |
| " 16 | 101 | — | — | 104 | — | Absent from home. No record of out-door temperature. Found six chicks out, and several eggs pipped at 10 P.M. |
| " 17 | 102 | 103 | 104 | 103 | 60 | Eighteen chicks out. Two partly out, which I helped. One egg pipped, but dead. One egg bad. |

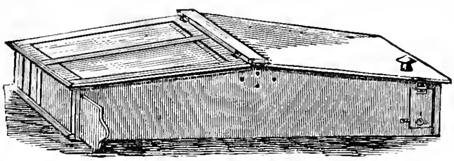
**Rearing Chickens Artificially.**—In order to rear chickens without hens successfully, and with profit, several conditions are essential. There should be provided a suitable warm house, with a southern exposure, and some kind of a warm house or brooder always available. In severe weather it will be necessary to keep the chickens confined within doors, but in favorable weather they should be permitted to run in an out-door pen. Nothing induces disease sooner, or makes chickens more puny and weak, than constant confinement in a warm house. They should be permitted to run out when the weather will admit, but should always have an artificial mother to nestle under when they wish. This may be made in various ways.



ECLIPSE ARTIFICIAL MOTHER.

A very good one may be made by tacking a piece of sheep skin, dressed with the long wool on, upon a barrel, the board to slope from four inches above the ground to two inches, so as to admit of different sized chickens to brood under. The sheep skin should be tacked only around the edges of the barrel, so as to fall a little loose and rest with its weight upon the chickens. A few small gimlet holes should be bored in the cover, and the skin perforated in places to admit of ventilation. This cover is boarded on three sides, the front being left open, except being finished with a flannel curtain, reaching the ground, which keeps out the cold air, and under which the chicks may run with the greatest ease.

The Centennial Brooder is adapted to both winter and summer use, and can be used in the open air or under cover. It is well ventilated, keeps the chicks dry in the severest storms, and is a perfect protection against rats or other vermin.



CENTENNIAL BROODER.

A poultry breeder in Wisconsin gives his method of making an artificial mother, as follows: "The mother I use is made of a piece of coffee sack, tacked tightly over a frame, on the opposite side of which is tacked a piece of coarse wire netting. The sacking is then "drawn" with pieces of soft woolen or flannel cloth torn in strips, the ends being clipped off evenly at the bottom and allowed to hang down about three inches. There should be a little platform about 1½ inches high, made a little larger than the "mother," and covered with road dust, on which the chicks nestle to raise them up sufficiently for the carbonic acid gas (which is heavier than air and settles to the bottom of the brooder) to drain off as it were. Next I have the tinsmith make a zinc pan just the size of the "mother" frame, and 2½ inches deep. Then four heated bricks placed on the wire netting, and closely covered with the zinc pan, furnish sufficient and safe heat. At night the birds will retain their warmth until the apparatus is thoroughly heated, and then the natural heat of their little bodies is amply sufficient until morning.

During cold and cloudy days, and always until the chicks are a week old, the bricks should be changed four or five times daily. This is no more trouble than to fill, trim, and watch a lamp, and fill the tank, and is very much cheaper, while you need not fear either fire or suffocation from over-heat. The brooder must be amply ventilated at the *bottom, not* the top. This brooder I place in a little rough shed, the east and south sides of which are made of hot house sash, and the floor (of rough boards) covered with road dust, and the arrangement is complete.

The Eclipse Artificial Mother is circular in form; the heat, which is applied above the chickens, comes from hot water which is contained in a covered tank inside the hover. This tank is surrounded on the top and sides by an inch of thick felting, and the whole is covered with a galvanized iron casing. The loss of heat is so small that the water will keep warm twelve hours; so that the hover needs emptying and filling at morning and night only, a gallon or two of water sufficing to fill it. Beneath the tank hangs a fleecy blanket, against which the chickens press their backs just as they do against the hen. The water is supplied at the top through an inch pipe, and is withdrawn through the faucet on the side.

If a large house is to be built, and a considerable number of chickens are to be reared, it will be more convenient and economical to have a boiler introduced, together with a number of pipes, than to have a number of single houses. Mr. E. A. Samuels says: "It is not best to place the chickens that are just hatched under the hovers. but to wait until they are twenty-four hours old. My own practice is to remove the chickens from the incubator as fast as they 'dry off,' that is, after they have been hatched two or three hours, and place them in a wide circular basket, the sides of which are lined with fur or sheepskin. From the top, hanging down into the basket so as to nearly touch the bottom, is a fur or sheepskin cover, and the bottom of the basket is covered with an old piece of carpet. The chickens huddle together in the middle of the basket, and the fur covering rests upon their backs. The basket should be set in a warm place near the stove.

There are a few openings provided around the fur cover, so as to admit fresh air, or the chickens would smother. In this basket the chickens remain until they are strong enough to stand up, and they are then, at night, transferred to the hovers. If the circular hovers are used, the young birds will get together under the middle, and there is no danger from overcrowding in broods of fifty chickens; but if the pipe brooders are used, the chickens should be placed under the middle of each brooder, rather than at one of the ends.

They do not need any food for twenty-four hours after hatching, On the morning succeeding their first night under the brooders, the chicks should be fed. Crumble up some crackers fine, and mix the crumbs with the yolks of hard boiled eggs, broken up fine.

The chicks will soon gather around the feeding dishes, if you will tap the end of your finger on the side of the dish in imitation of a fowl's bill in pecking and in a surprisingly short time they will learn how to eat; you can teach them to drink also, by dipping your finger in the water dish and stirring it a little. As soon as one chicken learns to eat or drink, the others will follow its example, so that it takes but a very few minutes to teach a large number of chickens.

After the young birds have eaten, gently push them under the brooders, and they will remain quiet for a number of hours, and when they want to eat again they will run out and satisfy themselves, and then return to the artificial mother precisely as they would to the natural one.

As soon as it is dark, if the hot water pipes are used as brooders, the chickens should be gently pushed to the middle of the brooders; otherwise they will crowd against the supports of the pipes or the partitions between the pens, and crush the inner ones to death. It is absolutely necessary that this should be done if one expects to operate with success.

The young broods are now started, and if they are properly cared for, there is no diffi-

culty whatever in raising them. They should be fed as early as possible in the morning, and should have a variety of food, *and only as much as they will eat up clean.* It is a good plan to give them as a soft food for breakfast, mashed potatoes mixed crumblingly with Indian meal. In two or three hours they should be fed again, and now they should have fine cracked corn, or crumbled Indian meal cake (made by stirring up Indian meal with boiling water and a little salt and then baked in an oven), and wheat or wheat screenings. It will soon be found that they have a partiality for some one food, and will pick out the choice morsels, leaving everything else untouched. In order that they may have the greatest variety of food, and consequently consume the greatest quantity, instead of mixing their food, I feed them at each meal first with the article of diet that they least like, and when they refuse to eat any more I give them something else, finishing off with their favorite. The point to be aimed at is to induce the young birds to consume the greatest possible amount of food, by which means they grow and mature very rapidly, and I know of no better way of accomplishing this than that I have described. At night they should have all they will eat of cracked corn and other hard grains, soaked in water, so that their digestive organs may be well supplied until morning.

The water vessels during the daytime should always be kept well supplied with pure, clean water; nothing is more likely to create disease among chickens than filthy, impure water, and too much care cannot be exercised in this direction. The ground under the hovers should always be cleaned and renewed every morning; a supply of ground bone should always be accessible to the chickens, and once or twice a week they should have grass, clover, or other green food chopped fine when the chicks are small, and in the natural state when they are a few weeks old.

It is a good plan to sow oats in frames in the chicken house for the winter supply of the chicks, but cabbage chopped fine is about as acceptable. I have been accustomed to feeding the very young birds with cabbage and turnips, chopped fine and mixed together, and can recommend the practice as a successful one. After the chicks are a few weeks old I throw these vegetables to them whole; the time it takes for a flock to tear to pieces and devour a whole cabbage is surprisingly short

The system of management that I have described has proved so successful with me that I can without hesitation recommend it to others; as by it I have absolutely no difficulty in rearing chickens artificially, and that, too, in our most inclement seasons."

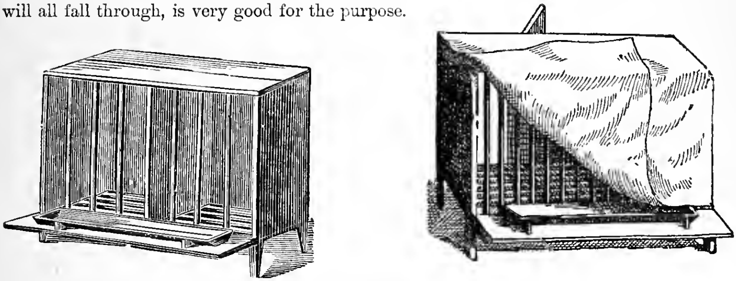
The brooders should have fine sand or ashes cover the ground under the brooders an inch deep, and this should be frequently changed in order to keep the surroundings as clean as possible. Cleanliness in their runs is likewise equally essential. The brooder, if neglected, is liable to get infected with vermin. To prevent this, dust sulphur or pyrethrum powder frequently into it. The true secret of success in raising chickens artificially may be condensed into a few words, viz., warmth, ventilation, cleanliness, and constant feeding, with a variety of suitable kinds of food. Let them also have the warm sunshine to lie and run in. Never permit the little things to go hungry, or to be neglected in any way; indifferent care will never prove profitable in poultry raising, and unless a person is willing to give his attention to it, he had better never undertake the business.

**Advantages of Artificial Hatching.**—While we do not believe any artificial means of hatching eggs will be found preferable to the old-time method of the "setting hen" when a small number of eggs are to be hatched, still where large numbers of chicks are to be raised, some advantages may be gained by the use of the incubator. By this means early chickens for the market and show-room may be procured; in fact, chickens may be hatched at any time during the winter, or at any time and all seasons of the year, as hens will lay well, when they will not always sit when desired; besides, when incubators are used, the hens that would be employed in hatching would be profitably engaged in supplying eggs. With

incubators, we may have chickens in December, as well as in June. When hatched in the winter, they will be more hardy, less liable to become diseased, and may be taken care of with less trouble, when there is a warm place provided for them; but if warm quarters are not provided, it will not prove worth the while to attempt it.

When chickens are hatched in warm weather, the sun burns them, unless there is an abundance of shade provided, while the excessive heat checks their growth, but not their appetites; hence, it will cost more to raise them, although they will not be ready for market or for exhibition in the fall when they should be fully feathered and nearly grown, to be best suited to either place.

**Fattening Poultry.**—If fowls are constantly kept in good flesh, it will not take long to fatten them. Most of the chickens found in the market are taken directly from the yards without extra feeding, but it will be found more economical generally to fatten them for from fifteen to twenty days before marketing. For this purpose they should be confined in a darkened coop, or pen, and fed three or four times a day all they will eat. The place of confinement should be kept as clean as possible, free from draught, and dry. It is better to pen them in small numbers, say from eight to a dozen in a pen, putting such together as have been accustomed to run together, otherwise they will be liable to quarrel, which will prevent their gaining weight. A coop with a barred floor, so designed that the droppings will all fall through, is very good for the purpose.



FATTENING COOPS.

The coop should be so arranged as to afford good ventilation without draught, and to be kept partially dark, with but little room for moving about much. The times for feeding should be regular, and the fowls given all they will eat. Corn meal made into a thick mush, thoroughly cooked, and fed cold, is excellent for fattening. A little corn may also be given. An excellent food for fattening fowls, whether old or young, is equal quantities of barley meal and corn meal scalded and fed warm. Fresh food should be given at each time of feeding, and only just what they will eat up clean. Keep clean water by them constantly, also gravel. Feed all they will eat, then darken the coop until the next regular time for feeding. Bits of fat meat will also hasten the fattening process.

By carefully watching, the proper time for sending them to market will be determined, which will be in from fifteen to twenty days. When the proper point in the fattening process is reached, they should be marketed immediately, as they will soon begin to shrink in weight. For home use there is probably no fowl meat equal to a chicken that has never been fattened at all, but having been well fed from the time of hatching, is taken directly from the yard.

The flesh of fowls that have always been well fed, will be much more juicy and rich in flavor than those fattened from a low state, and "crammed" just before killing. Poultry should never be permitted to range where they will pick up food unfit for them to eat, for it flavors their flesh and taints the meat. Chickens that have been obliged to pick up their

living from pig-sties, the barn-yard, and other unclean places, will not furnish as nicely flavored meat as those fed with clean, healthful food. A fowl cannot feast constantly upon filth and drink impure water, and furnish very delicate flavored or healthful meat for the table. Not only will the food eaten by fowls flavor the flesh, but the eggs also. Onions given to hens in large quantities will give a very decided onion flavor to the eggs. Chickens of the larger breeds will be grown enough for table use at from three to four months of age if well fed from the time they are hatched, while they are frequently used for broilers when from six weeks to two months old.

In France, and some portions of England, the cramming process is resorted to in fattening fowls. Two methods of this process are practiced: the forced administration of solid food, and that in a semi-fluid state. Buckwheat meal, bolted quite fine, is used mostly for this purpose. This is wet with sweet milk until it is of the consistency of baker's dough, when it is made into little rolls about the size of a lady's little finger, which are cut into pellets from an inch to two inches long. Each of these pieces of dough is dipped in water before being put into the bird's throat, when it will swallow it at once. The quantity given is according to the size of the fowl, care being used to increase the amount taken each day, to feed regularly, and never until the previous meal had been digested.

**Killing and Preparing for Market.** — Fowls should not be fed for at least twelve hours before killing; many prefer that they fast twenty-four hours. If killed with the crop and intestines full, the task of picking and dressing them will be much greater than if they were empty. Since poultry that presents the most attractive appearance in the market draws the most remunerative prices, it is the interest of the poultry raiser to kill, dress, and pack for market in such a manner as will insure the best condition. It was formerly the custom to wring the neck of the fowl in killing, but the better method of bleeding has become generally adopted. This is not only more readily accomplished, but the flesh is whiter than where the old-time method is practiced.

The best method of killing fowls is to open the beak, then with a pointed, narrow knife blade, make an incision at the back of the roof of the mouth, which will divide the vertebrae and cause instant death. The fowl is then suspended by the leg until the bleeding ceases. Dry picked fowls, or picking without scalding, when the fowl is quite warm, is the best way of removing the feathers, as poultry looks much better prepared in this way, and will generally bring a higher price in the market. If done when the bird is warm, it is a very easy task, and the skin will not be torn, while the extra price obtained will more than pay for the trouble. Fowls can be picked more easily by scalding, and this process also imparts to lean fowls a plump appearance. In scalding, care should be used not to have the water too hot; it should be just scalding hot, and *not boiling;* 190° is about the right temperature. Immerse the fowl, holding it by the legs, taking it out and putting it in again until the feathers come off easily. Do not let it lie in the water at all. Pluck the feathers off at once, and if properly scalded both feathers and pin-feathers will come off together. They should always be picked clean. Hang turkeys and chickens by the feet to cool, and ducks and geese by the head.

Fowls should never be sent to market undrawn; that is, with the internal organs left in. The undigested food in such cases soon enters into a fermentation, and putrefaction takes place, which in a few hours taints the meat, giving it an unpleasant flavor. The quantity of greenish looking fowls in the market are good illustrations of such results, while when cooked, will have a flavor that no amount of washing in soda water will obliterate, or high seasoning conceal. We are aware that it is customary in some markets to receive poultry undrawn, but if customers really understood the difference between fowls drawn and properly cleaned when dressed, and those drawn only as purchased in the market, they would, for sanitary reasons, as well as for delicacy of flavor in the meat, soon render the latter an unmarketable product.

Health, as well as other considerations, should be sufficient reasons why all poultry should be carefully drawn as soon as practicable after removing the feathers. In so doing, the opening should be made as small as possible, that the fowl may not look torn or mangled, and the heart, liver, and gizzard placed inside each fowl. In some markets the heads are left on, but we see no advantage in this. Hang the poultry up until quite cold and stiff, but never, under any circumstances, permit it to freeze. Hard freezing produces discoloration in the meat, and will depreciate the price in market.

**Packing and Shipping for Market.** — Having been well prepared for market by being carefully picked, the heads cut off and the skin drawn over the stump and neatly tied, — or when preferred, as is the custom in some localities, the head may be left on — the poultry should never be packed for shipment until perfectly cold; in fact, the nearer the freezing point, without being frozen, the better. The flesh should never be cut or bruised, or the bones broken. Clean boxes, free from dust, are better for packing poultry than barrels, as they are not so liable to become twisted out of shape in these as in the latter. Packages containing two hundred pounds are sufficiently heavy. When packing a variety of poultry, it is best to put different kinds of fowls into different packages, the kind being distinctly marked on the cover.

Clean rye or oat straw, free from dust and quite dry, is the best material for packing. This should be put at the top and bottom of each box, also at the sides and between the layers of poultry. In packing, the bird should be laid breast down, with the legs out straight, the head bent under and to one side of the breast bone. Lay a row of fowls across the box from left to right, packing close, row by row, until the place for only one row is left; then reverse the heads, lay them nearest the other end of the box, putting the feet under the previous row of heads. Fill all the interstices with straw to prevent shifting; also pack straw enough over each layer of fowls so that they cannot touch each other, and so proceed until the box is filled.

Straw should be liberally used at the top and bottom of each package, also at the sides and between the layers. There should never be any shaking about, or the birds will become bruised. The box should be firmly nailed, with the number of fowls and variety plainly marked upon it, also the name of the shipper, and the person to whom it is consigned, with the full name, street, and number. The receiver will therefore be more liable to get it promptly, and it will be known by a glance what the box contains without unpacking to find out.

**Preserving Eggs.**—Eggs that are packed in salt, in layers, with the large end down, so as not to touch each other, if put in a cool, dry cellar, will keep fresh from six to eight months, and can scarcely be distinguished from fresh eggs. Another method which is preferred by some is to add half a peck of new lime to four gallons of boiling water, stirring it well until the lime is dissolved; when cold, strain it through a course sieve to remove any hard lumps; add ten ounces of salt, and three ounces of cream of tartar, and mix the whole thoroughly. Let the mixture stand two weeks before using. The eggs for packing should every one be perfectly fresh. Pack them as closely as possible in a jar or tub, and keep them constantly covered in the pickle. It is said that eggs may be kept fresh by this means from one to two years. A writer in the English Mechanic gives the following method of preserving eggs:

"I have preserved eggs so perfectly that, after a lapse of six months, they were mistaken, when brought to the table, for fresh-laid eggs, and I believe they would have kept equally good for twelve months. My mode of preservation was to varnish the eggs as soon after they are laid as possible with a thin copal varnish, taking care that the whole of the shell was covered with the varnish. I subsequently found that by painting the eggs with fresh albumen, beaten up with a little salt, they were preserved equally well and for as long a period.

After varnishing or painting with albumen, I laid the eggs upon a rough blotting-paper, as I found that, when allowed to rest till dry upon a plate or on the table, the albumen stuck so fast to the table or plate as to take away a chip ont of the shell. This is entirely obviated by the use of the blotting-paper. I pack the eggs in boxes of dry bran."

**Breaking up Broody Hens.**—Some breeds of sitting fowls are much more inclined to be broody than others, the Asiatics, for instance, being quite troublesome in this respect, while there is also quite a difference in individuals in the sitting propensity. Many of the devices resorted to for breaking up this tendency are either futile or cruel. It must be remembered that this inclination is a natural one, and will be likely to be persistently followed until the fever is over, or some sensible means adopted to break it up. The cruel practice of ducking hens in cold water, tying them by the leg to a stake in the open air or sun, shutting them in a darkened and almost air-tight barrel, or throwing them off their nests a dozen times a day is all to no purpose. The better way is to let the hen sit a few days, and then remove her from the nest to a coop or some other quarters where she cannot have access to her former laying place, and she will give it up entirely in about three days after confinement. This will give her a little rest, which she needs, and she will soon go to laying again. It is well to have a large coop or department of the hen-house especially devoted to this purpose, where broody hens can be shut up apart from others until the fever is passed. If it is desired not to allow the hen to sit at all, she should be looked after at night; when found at this time upon the nest, remove her from it entirely before the sitting propensity has fairly become established. If put in a small coop by herself, being supplied with food and water, she will forget all about it in three or four days. When two or three birds are broody at the same time, it is a good plan to put them in a coop or pen together, and introduce a young cock to keep them company. Three or four days will usually prove sufficient time to break up the inclination, when they will give no farther trouble for a time.

**Preparing for the Shows.**—As all admirers of fine fowls are more or less interested in poultry shows, we give some excellent hints from Mr. I. K. Felch, with respect to preparing the birds to make a creditable appearance on such occasions: "The chicks that stand head and shoulders above the brood in which they were hatched, are to be given private quarters and extra care; their meals should be cooked, and the growth of their different parts watched, and nature aided in all ways possible. Care and watchfulness are the levers that move the poultry interest, and are the cause from which the results—prize chickens—are obtained. Ninety points in an adult cock reqnire a cockerel to score ninety-three, hence we see in chicks, "the child is the father of the man."

Why do we have no more nice cocks? The reason, in most cases, is that three-fourths of all the cocks moult in confinement. If we would have fine plumage, we should give them a fair chance to grow it while moulting. Rich, nurturing food, a chance to exercise, milk, and green vegetable food, are the requisites for the making of a prize winner. To reach above ninety points is to be quite sure of first prize, and three-fourths of the first-prize cocks score from eighty-seven to eighty-nine. If the breeder will think of these things while the birds are moulting, an extra point may be obtained, and success made certain. As the twig is bent the tree is inclined. If a flight feather in the chicken is left to fold outside, the adult set will be inclined to come in the same ungainly way. Pull the loose feather and allow the wing to fold, and the new set will grow out in proper shape. If the old feathers do not come ont evenly, remove the tardy feathers so that the bird may secure its plumage in a smooth and even color. If a buff, you must know that a feather coming in long after the moulting, has a darker, fresher look, which makes the plumage uneven in shade. If the old ones are left, they are faded, and give the plumage a 'mealy' look. So, if neglected, one is sure to have two shades of color, which, being cut a point, destroys the chance of success. See that the old feathers fall in time.

In Hamburgs it is quite common in the show-pens to see specimens where one-half the flight-feathers are the old ones, never having been shed. When you see the flights half or two-thirds cast, and the new feathers just starting, catch the fowl and remove the rest. Just so with the chick. Many of you have seen me pull feathers in a show-room with the remark that they were chicken-feathers. The feathers next to the last coat before a bird comes into reproductive life, have a thin-pointed end where birds have been confined; these, many times, are late in moulting out. Care in this respect, especially in Plymouth Rocks, should be taken to see that they are shed in time to get their new ones before the exhibition, and may save you the disappointment of losing a first prize. These are old stories to us, but if by calling attention to them one nice bird may be saved to win, we shall not regret the writing."

**Moulting.**—This is the most critical period for fowls during the whole year. It is the time when there is a strain upon the system, required in the casting off of the old and the production of a new growth of feathers, the manufacturing of their new suit of "winter clothes;" hence there is an extra demand upon their physical energies. We prefer to see fowls moulting quite early in the autumn, thus putting off their summer clothes and preparing for winter before the cold weather has fairly commenced. Early moulting indicates a healthy condition, and when it occurs the process is apt to be gradual, while if delayed until cold weather, the feathers generally fall off rapidly, leaving the hen in such an unprotected condition that she suffers extremely from the cold, and sometimes dies from the effects, or if she recovers, is not generally worth much. Late moulting indicates exhaustion from constant egg-production or other cause. During the moulting season hens are more delicate than at any other time, and require extra care. They seem to feel badly, and frequently mope about as though sick.

It should be the aim of the poultry keeper to favor early moulting, and to make the season as short as possible. This may be accomplished by giving such food as will induce a growth of feathers. Feathers are largely nitrogenous in their composition, consequently the food for poultry previous to and during the moulting season, should be such as has a large proportion of nitrogen. When fowls are allowed the freedom of extended ranges, like that of the farm, for instance, they will seek worms, grasshoppers, and other insects for themselves, which contain large proportions of the nitrogen element. If hens are confined where they cannot obtain such food, they should be fed with meat scraps, bone meal, or something of that nature that will furnish material for the growth of feathers.

Sheep's pluck, refuse from the butcher's shop, etc., may be obtained at slight expense, and make excellent food for this purpose. Oats and hemp seed are good for feeding at this season. Fowls should also have a little cayenne pepper mixed with their food, and be liberally supplied with lime in some form, such as powdered oyster shells, old plaster, egg shells, etc. Mr. Wright recommends that sulphate of iron be mixed with their drink during the moulting season and cold weather; the preparation being half a pound of sulphate of iron and one ounce of sulphuric acid, dissolved in two gallons of water, this to be added in the proportion of a teaspoonful to each part of water given the fowls. It is also highly important that hens be provided with warm quarters, and proper shelter during this season. Very comfortable henneries may be constructed with but little labor and expense, where more elaborate buildings are not desired, and will well repay the trouble of providing them.

**Feather Eating.**—This is an annoying and unnatural habit, that seems to be formed under confinement, and from a lack of exercise and want of meat and green food. We have frequently seen fowls stand perfectly still, and apparently contented, and allow another to pluck the feathers from the head or other portions of the body until the blood flowed, showing no indication whatever of pain or discomfort. This habit is imitated by others in the flock, and spoils the appearance of fowls. It seems to be a habit contracted in part from mere idleness—the want of something to do. Give the fowls a wider range, more exercise,

a variety of food, consisting of meat scraps, grain, vegetables, shells, bone, etc., together with finely cut, well-cured rowen hay. Corn fodder is also excellent, and should be kept by them. It is surprising what an amount of green food fowls will eat when permitted to have constant access to it.

**Egg Production. Quality of Eggs, etc.**—There has been considerable discussion among poultry breeders relative to the number of eggs which may be produced by a hen in a year. We believe it is generally conceded by those who have given the subject much attention, that with the best breeds for egg production the number of eggs will average from a hundred to a hundred and seventy-five per year with proper care, while even higher numbers may be reached in individual cases. Mr. A. M. Halsted says: "Some years since a tabulated statement went the rounds of the press, showing that a hen could not possibly lay more than six hundred eggs in the course of her natural life.

This number was parcelled out as follows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| The first | year after birth | 15 to | 20 | The fifth | year after birth, | 60 | to | 80 |
| " second | " " " | 100 " | 120 | " sixth | " " " | 50 | " | 60 |
| " third | " " " | 120 " | 135 | " seventh | " " " | 35 | " | 40 |
| " fourth | " " " | 100 " | 115 | " eighth | " " " | 15 | " | 20 |

This table was assumed and based upon a microscopic investigation of the ovarium of a hen, by some European savant. For once, science was wrong. Within the past five years, a number of persons have kept careful count and have found an egg-production of nearly one thousand, during the eight or nine years of a hen's life. I, myself, have had a yield of over three hundred and fifty eggs per hen, in two years; averaging one hundred and seventy-five yearly, from a flock of Crèvecoeurs, and my Brown Leghorns yearly exceed that record. Two years since from a flock of sixty-one hens at first, of which two died in February and March, and thirty-four were killed for the table prior to July, I gathered between January 1st and September 1st, sixty two hundred and fifty-seven eggs. Taking forty-three as the average number of hens through the season, this gives an average of one hundred and forty-five eggs per hen, for eight months. Of these sixty-one hens, only twenty-five were Brown Leghorns; six were Light Brahmas; four Plymouth Rocks, and the rest were crosses and mongrels. Had the flock been all Leghorns, I have no doubt but the average would have been fully one hundred and seventy-five eggs per hen.

This production of eggs may be forced by suitable feeding, and, in breeding for profit, it should be done. Assuming the table given above to be correct in the *proportion* of eggs laid at certain ages of the fowl, it follows that to get the full value of the egg-production, we must keep her until the fourth year. If, by proper feeding and attention, we can cause her to lay three-fourths, or more, of that possible number during the first two years, we can then fat her for market, and fill her place in the yard by younger fowls, to go through the same forcing process. It is folly to feed and keep a hen four years, when the bulk of profit may be obtained from her in half that time. I should, therefore, advise fitting her for market as soon as she has finished the best of her second season's laying, which is usually about June. The cocks may be kept until three years old if desired, but usually two years will be found the most profitable age to market them.

In the 'old times' it was a good flock of fowls which averaged fifty eggs per hen per annum. Now an average of one hundred is esteemed a low figure; one hundred and fifty per head being considered the necessary number to entitle a flock to be called *good* layers. We frequently hear of instances where an average of two hundred and upwards have been produced by small-sized flocks, but these are exceptions to the rule. In eggs, the improvement of quality is equally noticeable. The idea that *'an egg is an egg'* no matter whether fresh or stale, whether stringy and tasteless, or meaty and rich, has exploded. We find as much difference in the quality of eggs, as with any other article of food; the quality

being practically under the control of the breeder. If the fowls have to shift for themselves, getting a precarious living in the barn-yards or the stubble field, the eggs do not have the rich melting quality which results from a good generous diet of grain and prepared food. We might as well expect the same quality of beef in the half-wild steer of the prairies, as we get in the well-fed thoroughbred Short Horn."

**Profits of Poultry Raising.**—That poultry raising is always attended with profit is a question of grave doubt, but that it may be made very profitable when properly managed admits of no question whatever. In fact, we believe that no department of farm management can be made more profitable to the farmer in proportion to the labor and outlay than poultry raising, when conducted according to the most approved methods. When the most profitable breeds are kept, and are judiciously and systematically cared for, so that eggs may be supplied in abundance during the winter, when they will bring the highest market price, and chickens hatched early to supply broilers for the market, when such meat is most in demand, the profits must of necessity be very large in proportion to the amount expended for their production and growth. The same principle holds true where poultry is raised simply for home use.

Like every other kind of business, the profits in poultry raising will be found to be proportionate to the amount of intelligent skill and care bestowed upon the enterprise. There are three distinct markets that poultry may be bred for, viz.: fancy strains, table use, and egg-production. Which will return the greatest profit for the time, labor, and outlay in money will depend considerably upon surroundings and conditions; under any circumstances the profits will depend upon the manner in which the management is conducted. A person should never go into the business with the idea that there is no labor attending it. There is profit in the business, but in order to secure it there must be labor, and a judicious system. To show what the average profits of fowls may be when properly managed, we give the result of a few experiments, on a small scale. The writer, in keeping an accurate account of the expenses and products from a flock of twenty-five Light Brahmas for one year, found that the net proceeds were about two dollars and a half per head, and this when grain was at a high market rate, and bought in small quantities at retail prices.

Mr. S. A. Cooper, of Colebrook, Conn., states that he had a flock of ten White Leghorns hatched June 2d. On the first day of the December following two of the pullets commenced laying, and in five days from that time the ten were all laying. Between the first of December and the first of April these White Leghorns averaged in eggs produced $1.10 each above the expense of their keeping. Mr. Edward Hunter, of Norwich, Conn., says that he found by keeping a strict account of the expenses and returns from his flock of one hundred and twenty-five hens, made up of Leghorns and Plymouth Rocks, that from March 1st, 1882, until March 1st, 1883, his hens laid 15,600 eggs, or an average of 116 eggs apiece. Of these he sold 1,200 dozen, receiving therefor $375.75, or an average of thirty-one and a quarter cents a dozen. This left him for use in his own family 1,200 eggs; that is 100 dozen. He is satisfied that he made enough off from the hens, to say nothing of eggs the family ate, to pay for the keep of his horse and cow.

The following is an account kept by a young lady in New England, who experimented in the profits of poultry raising. The number of hens kept was sixty, consisting of White Leghorns, Dark Brahmas, and American Dominiques:

| | |
|---|---|
| No. of eggs sold, 417 $\frac{10}{12}$ doz. at 29 $\frac{1}{5}$c., | $121.76 |
| Amount of poultry sold, | 114.23 |
| Amount of poultry used in the family, | 20.00 |
| | $255.99 |
| Amount expended for feed, | 60.08 |
| Leaving a net balance of, | $195.91 |

This gives an average of $3.26½ per head for each of the sixty fowls.

Miss Mary Reed, of Amenia, N.Y., gives the following from her poultry account book: Year ending March 31, 1877—eggs laid, 3,842; sold, $246\frac{1}{2}$ dozen at 23 cents, $52.84. Fowls sold, 239 at $45\frac{8}{10}$ cents, $109.56. Total income, $162.40. Total expense, $60.14. Profit, $102.26. There were fifty-eight hens at the beginning of the year. Year ending March 31, 1878, number of hens 60; eggs laid, 4,377; sold $317\frac{1}{3}$ dozen at 21 cents, $66.59. Fowls sold, 171 at $42\frac{1}{2}$ cents, $72.72. Total income, $139.31. Expense, $37.15. Profit, $102.16. The average number of hens $35\frac{1}{3}$: average eggs per hen, 121. Net profit per hen, $2.90. Year ending March 31, 1879, 54 hens; eggs laid, 4,269; sold, $291\frac{3}{4}$, dozen at $23\frac{1}{2}$ cents, $68.71. Fowls sold, 294 at 44 cents, $129.02. Total income, $197.73. Expense, $40.82. Profit, $156.91. Year ending March 31, 1880, 65 hens; eggs 5,257; sold, $393\frac{1}{3}$ dozen at $22\frac{1}{3}$ cents, $88.45; fowls sold, 177 at $46\frac{2}{3}$ cents, $82.75. Total income, $171.20; expense, $27.75; profit, $143.45. Year ending March 31, 1881, 64 hens; eggs laid, 5,566; sold, $423\frac{2}{3}$ dozen at 24 cents, $101.68; fowls sold, 139 at $42\frac{2}{5}$ cents, $58.98. Income, $160.66; expense, $32.60; profit, $128.06. Average number of hens, 48; 116 eggs each; profit per hen, $2.66.

In stating what women have done in poultry raising, Fanny Fields gives the following results from her observation and experience, which is certainly encouraging to farmer's wives and daughters in attempting to make a profit with but comparatively little outlay in money and, labor and realize at least a little "pin money" from the enterprise; besides the occupation is pleasant and healthful, as it necessitates some exercise in the open air, and which would not probably be taken, were it not for some specific object like this:

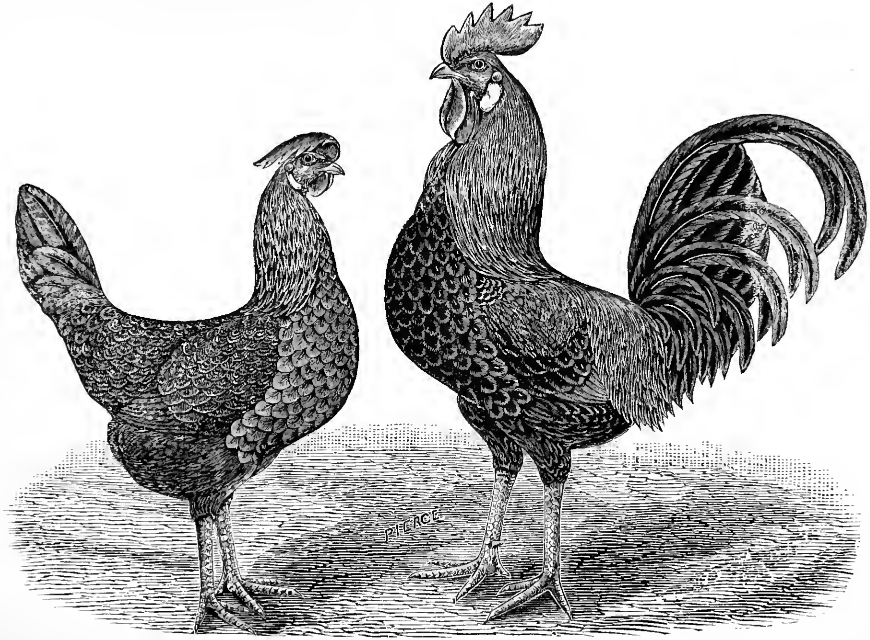
"Ten years ago a woman who lived in a large New England village was left a widow with four children and a little less than $300 in money. Friends, after the fashion that friends have at such times, advised her to put the children out, and perhaps she could support herself by sewing or teaching; but like the plucky New England woman that she was, she made answer: 'My children shall not be separated while I have health and strength to work for them.' She rented a house with a few acres of land adjoining, invested the greater part of the $300 in poultry feed and fixtures, and went to work. The friends predicted a speedy failure. 'Did she expect to support a family of five on the profits from a few chickens?' 'Yes, I expect to do just that.' she answered. 'When I was a girl I always managed the poultry on father's farm, and as I made it pay then I see no reason why I cannot make it pay now.'

'You'll see,' said the wise ones. 'It's our private opinion that you have thrown away the little money that you had. Five dollars for a rooster!' and eyes were rolled up and heads shook over the 'shiftlessness' of the woman who paid 'five dollars for a rooster.' Last winter we met this woman at a poultry show, and she told me of her success. She had educated her children, paid for her little farm (worth $800), and had $300 in the bank.

Another woman, whose husband fell from a building and was crippled for life, took up poultry raising because it was the only thing she could do at home; that was thirteen years ago, and to-day she owns a fine farm well stocked, and has money in bonds and in the bank.

A young woman whose health failed in the close confinement of the school-room, went to raising poultry because she was obliged to do something for a living, and because the doctors advised mental rest and as much active out-door exercise as possible. In two years her health was firmly re-established, but in the meantime she had found poultry keeping so pleasant and profitable that she refused to teach again. She has been in the business five years, and is earning a fortune as fast as ever a pair of woman's hands earned one.

Last year the writer made a profit of almost $1,000 on a breeding stock of some two hundred chickens, ducks, and turkeys. I don't publish this to boast over my success, but to show other women what a woman can do under the most favorable circumstances. The




**BROWN LEGHORNS.**
Owned by C. A. Keefer, Sterling, Ill.

favorable circumstances in my case were a splendid stock of breeding fowls, a healthy location, a thorough knowledge of my business in all its branches, and nearness to a first-class market. Of course some doubting individuals stand ready to declare that it is impossible to make five dollars profit on every adult fowl kept; but if they will stop and consider that I get spring chickens into market during the months of April and May, when they sell readily for one dollar each, that I sell ten and twelve pound capons for thirty cents a pound, that I manage to have eggs to sell in winter when I can get from thirty to thirty-five cents a dozen, and that I sell a few trios of exhibition birds every year, they will see where the big profit comes in.

Now don't stop here and give up all thoughts of raising chickens just because you cannot get such prices in your locality, but wait until I give you a few hints from my experience. I have kept poultry in the West where eggs sold at the stores for eight cents a dozen in the summer, and poultry sold in the fall for seven cents a pound, live-weight, but I made it pay. We lived on a line of railroad two hundred miles from a city market, but I soon found out that all the poultry and eggs from our place went to the city, and I could not for the life of me see why I could not ship such things just as well as the merchants. So I sent a thirty-dozen package of fresh eggs to a commission house in the city; they sold them readily, and there was a call for more. 'These small packages of eggs, every one warranted fresh, are just what we want,' wrote the commission man. I did some more thinking, and then put on my good clothes and went to the city. Once there, it did not take me long to find a grocer who wanted thirty dozen of fresh eggs every week, so I shipped the eggs direct to him, and saved the commission man's profit. In the fall I sold my poultry in the same way.

There was no thoroughbred poultry in the vicinity except that in my yards, and when people began to find out that my chickens were superior to the common mongrel fowl, they bought a great many eggs for hatching. There was not one pair of any of the improved varieties of ducks in the county. I sent a thousand miles for a pair of Pekins, and within a month after they arrived every body had the duck fever, and I was overrun with orders for ducks before a single egg hatched. I also procured some Bronze turkeys, and sold every egg that I could spare, and every turkey I raised at good prices.

Every woman who goes into poultry raising may not be able to get in these 'extras,' but every woman who desires to earn money by raising poultry, and goes into the business with a determination to succeed, will be sure to make it pay, even if she sells every egg and every chicken at market prices."

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## DISEASES OF POULTRY.

THE following on diseases of poultry was prepared especially for this work, by Mr. G. P. Burnham, a breeder of poultry for more than thirty years. Unlike many writers on this subject who enumerate forty or more diseases as applicable to the condition of fowls more or less frequently during their existence, he claims that the number of diseases commonly known to afflict the poultry race are few, and that many of the so-called diseases are but phases or different types of the same disease; that the primal or chief diseases of poultry may be set down pretty accurately in a very brief summary, although the following category are often seen described as being common to domestic poultry:

Apoplexy, Asthma, Roup, Vertigo. Paralysis, Indigestion, Catarrh, Canker, Pip, Colds, Gapes, Snuffles, Sore head, Hoarseness, Crop-bound, Inflammations, Drooping, Diarrhœa, Constipation, Dropsy, Scaly legs, Loss of plumage, White Comb, Black Comb, Diphtheria, Vermin, Lethargy, Rheumatics, Cramps, Dizziness, Egg-eating, Bumble-foot, Gout, Feather-

eating, Collapse of Muscles, Debility, Breaking down in the Limbs, Egg-sac Rupture, Dysentery, Fevers, Moulting, Cholera, and *other* afflictions unknown.

Here are some forty, only. Now of this extraordinary list of *so-called* "diseases" among poultry, there are but about half a dozen actual ails which domesticated fowls are generally subject to, that go to make up this elongated, horrifying list. And these, as a rule (not of course invariable, because there are exceptions to all rules), are in the main manageable, preventable, or curable — through the exercise of a goodly share of common sense, a little ordinary intelligence, some practice, and a kindly disposition towards the sufferers.

*Roup*, for instance, in its various phases, is simply catarrh, diphtheria, hoarseness, snuffles, inflammation in the throat and nostrils, a cold, sore head, diarrhœa, loss of appetite, lethargy, drooping, cramp, asthma, dizziness, general debility, fever — and death. This is ROUP — *pluribus in unum* — many in one.

We propose, therefore, to consider the Diseases of Poultry under five or six general heads, only; inasmuch as, if we take cognizance of ROUP, INDIGESTION, external and internal INFLAMMATIONS, LICE, CHOLERATIC attacks, and accidental affections, we may account for the causes and effects of all the ills otherwise named by astute poultry writers of former or more recent times.

In *all* cases it is necessary that the fowl-doctor shall know what the trouble actually is, when he is about to attempt to administer relief to ailing birds. With this foreknowledge a great deal of unnecessary fowl-murder may be avoided.

**Chicken Cholera**—So called, is a new disease in this country, about which but little is known in New England, and which has been treated with but indifferent success at the West and South, where it is stated to have largely prevailed in the past ten years. From all we have seen and what we have read on the subject, however, we have formed an opinion upon this ailment; and we will briefly state our views about what is denominated "chicken cholera." It is a curious complaint, which we in the North have had little experience with, except in its mildest and manageable form. The symptoms are those analogous to a sudden attack of violent diarrhœa; preceded by lassitude, sluggish movements, early prostration, and a general inertness in the victim assailed.

After death, which ensues in a brief space of time succeeding the attack and rapid sinking of the fowl into semi-unconsciousness, the liver is found to be swollen and flabby, the crop distended, the stomach foul, the gizzard filled with dried food, and the entrails inflamed. There is, previous to death, a sharp diarrhœa, wasting the life out of the bird, which ordinary treatment does not appear to affect or check at all. And from these indications and symptoms (which are not unlike some of those attending the Asiatic scourge in man) this disease has been denominated *cholera*.

Mr. W. H. Todd, a noted Western breeder, has had some experience with this fowl trouble, and he states that much of what is *termed* cholera is something else. He has once or twice fancied that his flocks had a touch of a disease akin to the reputed "fowl cholera." But he checked this (whatever it was) by the free use of carbolic acid disinfectants, and subsequently by thoroughly purifying his hen houses by fumigation.

We read that desperate diseases demand the application of desperate remedies, and in several instances where the premonitory symptoms have thus shown themselves, the alarmed owners of the menaced fowls have administered calomel and blue mass—in two-grain doses, or four grains of blue mass mixed with two grains each of gum camphor and Cayenne pepper—say twice a day. This we should say would either kill or cure, certainly! In the cases referred to, the experiment proved fortunately successful; albeit the owners acknowledge that they were not positive that the threatened disease "was really *cholera* or something similar."

It has proved quite contagious, nevertheless, in certain districts. And yet it is clearly

of a typhoid dysenteric character, from the outset. The remedial treatment thus far experimented with has not been encouragingly successful, inasmuch as most of those who have suffered from its presence among their stock, have acquired no knowledge of its cause, or what mode is best to adopt as a curative. Meanwhile the malady is of so violent a character that when it comes upon their premises, their birds die by scores, before they can decide what is the real difficulty, or how they may contrive to relieve them. We have no doubt that bad *locations* have much to do with this trouble. And we seriously opine that if seen to at once in most places, and (as in Mr. Todd's case) treated vigorously—*as for malignant dysentery, or inflamed diarrhœa,* the birds may be saved, in many instances.

But—as in all other cases of fowl disease which we have herein noted—we claim that if the chicken premises are kept uniformly cleanly and sweet, if the hen-houses are not overcrowded and are daily well-ventilated, if the stock is fed judiciously with sound and varied food, if the poultry is kept free from lice and are housed comfortably in cold and bad weather, and pure fresh water is furnished them, always—there will be little or no "chicken cholera" about.

If we have had this distemper in New England at all, it has not been of a serious character. It may be that our climate here favors us in this respect. But all the complaints that reach us come from the west and south, and there this plague has been very troublesome and severe. Wherever our attention has been called to this illness, we have, upon examination, found the ailment to be a phase of slow fever, at first, and subsequent virulent diarrhœa.

In these instances the birds have gone down gradually, but constantly, in condition, for weeks from the beginning. Up to within a few days or hours before death, they have eaten well—evincing continual thirst. Then diarrhœa has set in sharply, and they have expired. I consider this clearly a phase of dysenteric *roup*—and for this only should I treat the affection, if it should exhibit its symptoms in my runs.

But there exists some *local natural cause* for this wholesale destruction of domestic birds in certain districts, unquestionably. This malady is largely fatal in its work, and in the west it is clearly of a destructive character. It is said by those who have examined diseased yards that the cause has been found to have been generated in the place or its immediate vicinity (in several cases) where the trouble was most fatally severe. And this ruin was occasioned by the miasmatic, putrid, filthy condition of the soil (and neighborhood) where these fowls had long been kept.

Now the *cause* for this generation of malignant disease should not be suffered to exist at all. Fowls cannot be kept in or upon such infected disordered foul spots. And the remedy—to begin with—must be to remove the living stock beyond the baleful influence of such miasmatic death-districts, or apartments, or else remove the putridity, filth, and poisonous deposits (whatever they may be) from the fowl premises, and their neighborhood. The trouble is no doubt brought about, in the first instance, from the exposure of the stock to infested, swampy, or foul grounds and runs—or by keeping the birds in contiguity to such miasmatic or befouled premises. This disorder exhibits many of the symptoms which are premonitory in human beings afflicted with malarial *cachexia*—such as a paling and sallowness in the features, loss of flesh and condition, rapid diminution of muscular strength, general nervous lassitude and prostration, and the liability at any hour to sink suddenly under any incidental disease that may assail the subject, at such a time. The approved remedy for this affliction to *humanity* is the removal of the patient entirely from the vicinity where the affection originates to a purer atmosphere, and uncontaminated soil. And, subsequently, to restore the stricken bodily system through wise treatment, good food, and sustaining tonics.

A similar method would, in our judgment, unquestionably recruit a body of domestic fowls—but the suggested remedy should be seasonably applied. And the sooner this change

is made, upon discovering the above noted choleratic or malarial symptoms, the greater the proportion of birds will be likely to be saved from death, after being attacked by this "chicken cholera." If we should find it breaking out in our runs, *we should directly apply the remedies we have suggested for aggravated dysentery.* But so long as fowls are housed and kept, sheltered and fed, as we have long been in the habit of attending to ours, we do not fear any of these disastrous visitations among our flocks. We reiterate the convictions—impressed upon us during long years of practical trial and experience in this business—that cleanliness in the fowl houses, dry soil in the runs, pure air and plenty of it, proper ventilation at all seasons, good varied food, attentive care, fresh, untainted water, absolute exemption from vermin, and a love of the occupation, are the requisites towards breeding poultry advantageously; and these comprise the necessities for keeping them in good health, and continuous thrift.

**Indigestion, Inflammation, etc.**—Ordinary indigestion in fowls is of two kinds, and operates disastrously upon the crop, the stomach, and the bowels. Undigested food halting in the crop —whether dry or fluid—causes aggravated swelling and distention; the contents become hard and cakey, or puffy and watery, as the case may be. The disease is sometimes slight and temporary in duration, working itself off without inconvenience save through causing the bird to fast, by the removal of food from within its reach, for a day or so. In other and more numerous instances, however, the fowl becomes "crop-bound," after a while, and the contents of this first receptacle for its food grows hard and harder, still swelling more and more, until it must be relieved of the sodden load, or the bird will die. The process of remedy for this difficulty is simple, but it must be deftly and carefully performed. An opening should be made by one person, while another holds the bird, by an incision in the outer skin of the swelled crop, at the upper side—and through this horizontal slit, say two inches long, the caked food may be turned out slowly and cautiously, until the offensive undigested matter is removed.

Then, with a sharp fine needle and white silk (for most colored silk poisons the flesh), the edge of the opening should be neatly sewed together again. The relief will be immediate. The bird should be fed sparingly for a week afterwards, on cooked soft food, allowed little drink meanwhile, and it will commonly recover. All this (as in other cases of chicken-doctoring) is not worth the trouble involved, unless the diseased fowl be a valuable one. Indigestion generally causes inflammation of the gizzard and liver, and the bowels become constipated, in consequence. But most commonly it operates quite oppositely, and diarrhœa or dysentery is the result. In the latter case, the character of the affection is readily seen in the frequency and nature of the abdominal discharges. White and streaked, yellow, thin matter is voided. The bird rapidly loses flesh, and becomes weak and listless. And in a few days the disordered intestines are highly inflamed.

If attended to seasonably, the progress of the unnatural discharges may be without much difficulty arrested; and the fowl comes up again as rapidly as it went down, in spirits and strength. The evil may have been occasioned by the indulgence in too much green food, which sours and ferments in the crop or stomach, sometimes; or it may have been caused by exposure to wet and cold, or bad dry food, and "damaged" corn. Change the diet at once, in either case. Give drink sparingly, and only such as is impregnated with iron tincture, or cayenne pepper. Administer a few grains of dry ground rhubarb with as much common black pepper and powdered chalk—mixed in mashed boiled rice. This will shortly cure the bird, in ordinary cases. We do not advise the use of opium (as some do) and have rarely found any benefit from it. When the fowl is brought so low as to require this powerful astringent—or, on the other hand, to need mercury, or even "blue mass"—we have not deemed it worth while to resort to the sometimes recommended agencies; having little faith in the efficacy, save *in extremis.*

Indigestion will cause dysentery, diarrhœa, constipation, stomach cramps, swelled crop, loss of appetite, fever, and general disorder in the internal functions. Thus, under one head we refer to all these, and advise due care in feeding, and properly contrived quarters for sheltering, at all seasons, as a prevention to this not uncommon malady among poultry. The symptoms of this trouble are very plainly exhibited, when a domesticated bird is affected by it seriously. There is no mistaking the fluid discharges, the straining to void this mucus, the rapid decline in the flesh, and the spiritless condition into which they droop, after a brief term. And it will be necessary to look to them promptly and energetically, as soon as the indications mentioned are discovered—or they get beyond the reach of doctoring, from the excessive internal and intestinal irritation occasioned by this indigestion, and their continuously ineffectual exertions to relieve themselves, in the natural way. But this irregularity, like other diseases, must not be mistaken for what it is *not*.

**Lice.**—Though not of itself literally a *disease*, the presence of house and body vermin is absolutely the great cause of more torment, sickness, and destruction to chicken and fowl life than *all* other evils to which poultry is subject. Young birds are more frequently killed from being infested with lice on the bodies, in the nests and coops, or about the roosts they frequent, than through all other causes poultry-keepers wot of. There is no controlling the depredations of these insidious parasites, save by their extermination, and this can be effected only by constant care and vigilance. The whole feathered tribe (in a domestic state) is peculiarly subject to this infection. Many persons who keep fowls, pigeons, or pet cage-birds, do not understand this. And rarely taking effective measures to prevent their accumulation, they know not why it is that their fowls fail, droop, sicken, and die—one after another, from no apparent organic indisposition. The trouble is they have been "eaten up alive," by vermin.

Upon young chicks of the crested variety, such as Houdans, Polands, etc., the tufts of their heads are a favorite shelter for vermin; and hundreds are thus destroyed, annually, by these parasites. Great care should be exercised by breeders of these varieties, to keep their chicks free from this nuisance. It is not sufficient that you clear out this pest once, or twice, or thrice. If you continue to breed fowls, you must not only continue to drive these parasites away, but you must keep them at a distance—or they will beat you, in the end. Lousy fowls are never healthy, and are usually short-lived. Three-fourths of all the chicks that die before they are two months old, are killed by vermin. And those who lose them can never account for the fearful mortality accruing among their chickens. But all this destruction may be avoided, and there is a certain remedy for this offensive and troublous nuisance; which precedes and fatally aids the inception, progress, and finale to all other described "diseases," save those of accident or inheritance.

Prevention *of the possibility of their presence* to any extent, in your hen-houses, or upon the bodies of the fowls, is the only positive cure for this evil. To effect this, the building, however economically constructed—should be of dimensions proportionate to the number of birds you keep under a single roof; and these should be rendered comfortable for the stock. When you first place fowls within the house, see to it that *every* bird is cleansed from lice, before he or she enters it. Don't *begin* at the wrong end, by putting lousy fowls into a new or clean hen-house. To clear them of parasites, rub dry powdered sulphur, or carbolic powder, thoroughly through the feathers (to the skin) of adult fowls; and under each wing of cocks and hens, smear a little mixture of lard, sulphur-dust, and kerosene—as well as a dab of this also at the back of the head, and around and above the vent. Follow this up (outside your clean house) for three days—and you will thus, when you introduce your birds to their chosen premises, carry in no vermin from the commencement.

Upon young chicks, the lard and kerosene should be dispensed with. The powdered sulphur alone, or the carbolic powder, if thoroughly applied, is sufficient on their little bodies;

and the other is too pungent and penetrating, until they are older, and tougher-skinned. Now, sponge the roosts once in a week or fortnight with kerosene, or spirits of turpentine. Do this in the day time. It will thus dry off or evaporate mostly by nightfall. The *fumes* remain, however, and these are death to the parasites, if any are about. Next, dust the laying-nests and the sitting-coops, with the sulphur. Place under the straw where hens sit dry tobacco leaves, if convenient. And upon the bottom and sides of nest-boxes rub the kerosene, occasionally.

Figs. 1 and 2 represent the mammoth body insects (largely magnified), that burrow among the down of geese and upon the thick under-plumage of the peacock. Fig. 3 represents the duck-louse, an insect that seeks shelter on the soft downy feathers of the duck.

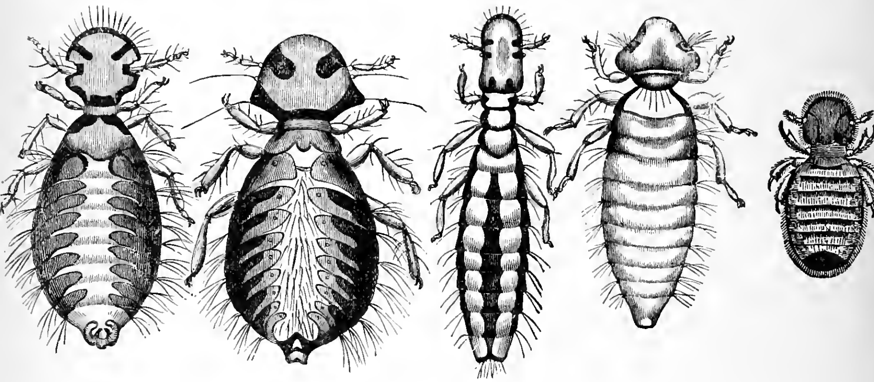


FIG. 1. FIG. 2. FIG. 3. FIG. 4. FIG. 5.

POULTRY VERMIN.

They are not usually very troublesome to the old duck except when confined in close quarters, and especially when sitting. They are a rapacious little insect, and the ducklings will be liable to become infested with them unless the mother has been cleansed before leaving her nest with her young flock. Figs. 4 and 5 illustrate the lice most commonly seen upon hens and chicks. These are but a few of the many species of parasites that infest poultry, and which may be exterminated by proper care. Among the varieties of parasites that breeders have found excessively troublesome, none have proved more difficult to destroy or get rid of, when once they obtain possession of the fowl premises or get a hold on their bodies, than the small *red* louse (or "red spider," as some call it, being not unlike the greenhouse *aphis*), which infests many localities. This kind of vermin is not generally common, but they are very annoying, and destructive as well, if they are suffered to accumulate.

Sulphur alone dusted upon fowls will not destroy this "red spider." But a thorough fumigation of the house they infest, by closing the building tightly and burning a few pounds of resin and sulphur together inside, will "clean them out." Carbolic powder rubbed through the fowls' feathers, and the washing of your roosts with kerosene two or three times will finish them effectually, if this be faithfully done. In the dust-boxes, where the fowls enjoy their daily roll, place finely sifted leached ashes, and a pound or two of the powdered sulphur mixed. Fumigate your houses twice or thrice in a season, by burning a pot of crude brimstone and rosin inside (when the fowls are absent, and it is tightly closed up), and whatever

else you may be troubled with, fowl *vermin* will not annoy you, your poultry, or your premises—when once you are rid of this nuisance; which, as we have intimated, is the most trying, destructive, and pernicious secret scourge that afflicts domesticated fowl flesh.

**Roup and its Phases.** — This common fowl malady, which is designated by various different hard names, as we have indicated — embraces the ills usually denominated by the superficial observer as sore head, inflamed eyes, diphtheria, pustulated nostrils, a cold, hoarseness, heavy breathing, foul throat, snuffles, drowsiness, canker, blindness, drooping, cramps, fever, or general debility, etc. It is so complicated in its character, and outwardly so varied in different cases, it is not surprising that so many different titles should obtain for its numerous phases;—but all is *roup.*

It is brought on and confirmed by keeping fowls in damp, cold, sunless quarters. From their exposure to wet, chilling weather, and drafts of harsh winds. It results through neglect of the birds' ordinary comfort, and by their eating poor food. It will be caused by obliging your stock to drink foul, stale water, or by serving them with "damaged" grain. It will attack the flocks that are compelled to live and roost in badly ventilated hen-houses. Filthy floors, covered by or impregnated with their accumulated excrements, will thus sicken them. In these poor conditions, *vermin* will assail the weakened birds without mercy, and this adds to the evil and augments the roup amongst them, inevitably.

A roupy fowl may be known from any of the symptoms or indications first above noted. This disease is insidious — as well as multiform in the outward tokens of its approach, or its presence. It breaks out suddenly, often, and attacks several birds, apparently, at about the same time. The victims will droop, appear indolent, gapey, listless, and uncomfortable. The heads swell, the nostrils fill up, the comb and wattles turn pale, they breathe heavily, sulk around in the corners of the coop or run, snip, and sneeze, grow blind from swollen pustules gathering in and around the cheeks and eyes, lose their appetites, and finally fall away and die.

The earliest certain signs of this disease among the flock are usually discovered by the inordinate listlessness of the victims, and their moping about sluggishly. Loss of appetite is also an early token of this illness. The comb of the hens whitens — or sometimes turns dark colored. The breathing grows stifled, and the breath becomes foul. The eyes are first watery, and then fill (often to blinding), with acrid mucous matter. Pustules form around the upper portion of the beak, in the gullet, and around the eyes. The head is inflamed. They gape, and gasp, "rattle in the throat," become ruffled in plumage, and decline to mount the roosts at evening.

Roup generally comes on gradually. But it often occurs suddenly — from contraction of a severe cold, in wet, bad seasons. Fever ensues, the eyes close up with the swelling of the cheek glands, and thus the poor bird cannot see to eat — if inclined — which generally it is not, in this state. They suffer greatly from thirst, evidently, in the meantime.

The crop is generally found more or less distended, and the sufferer appears in pain, constantly. The nostrils are soon closed with the swelling and accumulating pus also, and they breathe with marked difficulty. So long as they can see, the affected birds will drink, incessantly. The forming pustules exude a froth, at times. This falls from the sores into the water-vessels, and the well fowls drink from the same fountain. This sickens others; and the contagion quickly spreads through the flock — if the afflicted bird or birds be not in time removed from amongst their companions.

Common powder of sulphur (as well as pulverized charcoal), is an admirable ingredient to mix in small quantities with soft fowl feed. Say a teaspoonful in the mash for a dozen adult birds, in one daily feed for three days at a time. This operates as a laxative, and the sulphur works outward through the skin-pores — thus assisting to keep the birds' bodies free from vermin to a certain extent. Raw onions cut up fine, as an occasional "green food,"

act similarly upon the system; and are highly beneficial for the purposes above noted. Fine sulphur, powdered charcoal, and chopped onions — when given discreetly — will each and all be found very serviceable to adult birds, especially when inclined to be roupy — as correctives, laxatives, and purifiers of the crop and stomach, in cold or hot weather.

Roup attacks fowls of all ages, but generally the younger birds and chickens are not so liable to it. It is both chronic and acute, and its contaminating influence is remarkable, where prompt remedies are neglected. Whole yards have been decimated by it, in a few weeks, where the sick birds were left to run *ad libitum* with the healthy fowls. And this result has been denominated in certain quarters, undoubtedly, by uninformed persons, "an attack of Chicken *Cholera*" upon their premises. Roup, therefore, like the mischief occasioned by lice, is but little comprehended. None but experienced poultry men recognize this baleful disease in its true light, and *they* learn about all its wretched characteristics and difficulties only by slow degrees, and after many losses, as well. Its ramifications are extensive, and its phases are both curious and threatening, if the disease gets a fair foothold in one's runs.

Catarrh is roup. We are well aware that enlightened Doctors of medicine assert that these two are different diseases. But we are writing about the ails of gallinaceous poultry, and not about those of human beings. Men and women are not afflicted with *roup*, thank Heaven! but they live a great many years, and suffer with catarrh; while in poultry the symptoms of both are identical. And so, as far as our careful observation goes, we have found that what medical men declare to be "catarrh" in fowls, is simply and clearly a phase of roup.

The cure for roup is, at the earliest moment after any of the first symptoms described are discovered, to take the affected fowl away from his or her mates, and nurse it, if it is to be "doctored" at all, at a distance from the others. Let such sick birds have clean, dry, warm quarters, and if not too far advanced, the head and nostrils may be thoroughly washed with Castile soap-suds, and then with weak alum-water, or a solution of chlorate of potash, thrice a day. After a day or two, bathe the head and nostrils in whisky, or diluted spirits of camphor — and give a little Cayenne pepper in warm cooked mash, for food. A couple of mustard or pulverized ginger pills, the size of small marbles, in each warm feed, are very good. As soon as the bird can see to drink, give him Cayenne pepper in the water. All these are warming, corrective, and good tonics. A most excellent mixture for a daily injection into the throat and nostrils, is a solution of sal-soda and another of chlorinated lime, half and half, put into four parts of water. This will remove the morbid deposits around the head and beak, and cleanse the disordered parts.

Dr. John C. Bennett used to advise the administering of pulverized charcoal, powdered sulphur, and new yeast, — three equal parts, in a flour pill the size of a hazel-nut, three times a day, for a roupy fowl, — accompanied by the bathing as above. But what the fowl most needs is cleanliness, warmth, and dry quarters for a few days. If the case is not severe, he will recover. If it is a very bad one — knock the bird on the head and bury it. If you have several cases at one time, before you take them in hand — take away the healthy birds promptly, and apply the above remedies to the rest. And if they are worth saving, you will be able with care to restore them, after a week's attentive nursing, bathing, and feeding. To avoid the presence or assaults of roup in your fowl-flocks, we recommend a better "remedy" against this ugly disease than the cures proposed. This is *prevention*.

There is no need whatever that a breeder should be greatly troubled with any of the phases of roup. Watchfulness on the part of the keeper for its probable appearance in bad weather, and *immediate* action, as soon as the first symptoms appear in any one individual bird, will stave off this disease at any time; and it cannot thus become serious. But best of all, is so to provide for your stock that they shall have good warm shelter, in cold and stormy weather — that they may not be huddled together in masses, to poison each other with the

foul emanations from their bodies, by day or by night — that they may have sweet, fresh water daily to drink — that their food be cleanly and nutritious; and above all, and over all, that they be not exposed to the depredations of devouring and enervating lice. And thus you will have little or no *roup* among them, of a dangerous or unmanageable character.

If left to forage for themselves in wet or foul yards and malarious grounds, if exposed to cold draughts in the house, and raw winds outside, if suffered to waddle and wade in barnyard filth, and drink stale, putrid water, if compelled to eat foul food, and but little of it — they will not only get lousy but roupy, as well; and you will find that fowl-keeping in this loose, improper, inhuman style "don't pay," and it ought not to be remunerative, under such conditions and such reckless usage. But, as we have observed, this "roup" disease is in its indications and operations both manifold and complicated. And hence the various kinds of names that different inexperienced persons give to it. Yet it is wholly peculiar to *domesticated* fowls, alone.

Therefore the *cause* of the malady must be looked for in the conditions which surround the tamed feathered race; inasmuch as no authority has reported an instance where a wild turkey, grouse, or prairie hen—a partridge, pheasant, or quail—a woodcock, snipe, or teal—a wild goose, duck, or other sea-fowl—snared or shot, ever yet was found in its native, free condition exhibiting *any* token of this roup about their bodies, externally or internally.

And since this affliction so often falls to the lot of the dumb creatures we attempt to keep around us for profit (or that they may conduce to our pleasure, convenience, or partial sustenance), it is but dutiful that we use proper care, if we keep them at all, that our poultry be so attended and provided for, that the pernicious *causes which produce this trouble* may not be permitted to exist about our farms and poultry premises; when, in such large measure, the evil may so readily be kept at a distance.

By the observance of the suggestions we have made, this curse of the poultry-house may be avoided. In no other way can roup, in some or all of its obnoxious phases, be kept from infecting your fowl-stock. And however easy it may be to the skilled breeder to cure this disorder, when he finds it unfortunately breaking out among his flock, the labor of averting the cause of its attacks is far less than the trouble it occasions to eradicate the nuisance, after it fairly shows itself on the premises. For this good reason we advise the humane and economically disposed fancier to look well to the possible *prevention* of roup in his fowl-houses, rather than to the best way to remedy the evil, which, with due care, he may rarely or never be annoyed with.

**Accidental Maladies.**—These include many of the nominal "diseases" of fowls—as set down in the categories of the poultry books, to wit.: Apoplexy, heart disease, rheumatism, neuralgia, deformities, frozen combs and feet, feather-eating, egg-devouring, wounds from fighting, temporary blindness, loss of plumage, colds, common fevers, paralysis of limbs, the "pip," "gapes," costiveness, discolored comb, bumble-foot, scaly legs, etc.

The above enumerated ills are more or less common in a mild form among domestic gallinaceous fowls at all seasons of the year. But these evils are incidental, or accidental in great part, to poultry life. Some of these affections are not discoverable by, or explicable to, the novice or amateur; and it is only the experienced breeder who detects the real character of some others of these difficulties, bad habits, misfortunes, or accidents.

Acute rheumatics, sprains, neuralgia, paralysis of the legs, colds, coughs, and occasional temporary loss of vision (by the closing up of one or both eyes) are simply *local* diseases, brought about by local and removable causes. With any of these troubles, fowls are usually not sick a great while at a time. Lameness, or "breaking down" in the legs from apparent partial paralysis is the most serious of all these accidental difficulties. If this proceeds from an affection of the spinal cord (as is sometimes the case) it is incurable; though a fowl may live for weeks or months after the attack—helpless as to locomotion comparatively, but other-

wise in good health. Neuralgic affections are similar to the rheumatic, and these are terms used synonymously among technical poultry men. The nerves rather than the limbs are affected by this disease. It is not a common complaint, however, and little is known of, or about it.

Deformities—such as hump-back, knock-knees, wry-tail, imperfect comb or wattles (of their kind) twisted wing-joints or turned wing-coverts, crooked toes or feet, etc., are generally hereditary incidents in poultry breeding. Sometimes these defects come from careless mating, sitting on perches that are higher at one end than the other, or through breeding in-and-in too long; that is, from the same family of stock upon its descendants, or with its progenitors. The only remedy for these "accidents" is to avoid the use of such deformed birds for purposes of reproduction of the species. A boiled or roasted cock is not likely to transmit his imperfections to posterity,—if this is the only (and best) use that can be made of his carcass.

Eggs are sometimes, when ready to be laid, accidentally broken in the abdomen of hens. If the fowl be strong, and in good condition at such a time, the disaster may be repaired. A teaspoonful of castor-oil, by injection, will work the wreck away in a single night. But this misfortune frequently proves fatal nevertheless. Other hens, especially fat old Cochins and Brahmas, will "break down behind" occasionally from this same cause, or on account of their gross adipose condition, oftenest. They will then waddle about upon their haunches and stern, with their bodies erect, like that of a Penguin, naturally. But they rarely recover from this condition to be useful afterwards.

Frozen combs, feet, or frosted wattles, and white or black comb (so designated from its different colors at times) are, as a general thing, occasioned by exposure in the night to severe chilly winter air. With the class of birds wearing thin upright high combs, this trouble is common in New England and the North, in our sharp cold winters. In these instances of "frost-bites" the wound may be cured by placing the comb or wattles in cold water, or by bathing the affected parts thoroughly, first with fresh clean snow, then by washing thoroughly in camphorated spirit. After this, bathe in sweet oil, and press the latter into the pores of the comb or gills, over and around the frost-marks. Except in very severe cases, this treatment will effect a cure. In any instance, the saving of a goodly portion of the comb and wattles may be assured. This remedy should be repeated two or three days, successively, for frost-bites.

Feather-eating and egg-eating by fowls are bad *habits*, but are not a "disease." For the first complaint the birds should be kept *occupied*, when cooped in confinement and compelled to huddle together closely, for lack of spacious home quarters. Strew the house-floor thickly with dry leaves, or short-cut straw; and into this scatter their daily allowance of dry grain-food—oats, barley, broken corn, etc. They will scratch for it to the last kernel; and thus have no leisure to pluck the feathers from the necks and sides of their otherwise listless companions. To prevent egg-eating, give them *dark* nests to lay in, in secluded corners or passages, where they cannot *see* their eggs, when dropped. They will soon forget this destructive kind of trick.

Wounds occasioned by frost, from fighting, or other accidental causes, may be healed up speedily with a wash of carbolic, or castile soap-suds, and then with rum or whisky, alternately, for a few days. Olive oil as a final ointment for cuts and flesh contusions, is very healing and effective, and for ordinary inflamed eyes and head, a wash of weak white vitriol, or alum water, or alum and camphor combined, is excellent. "Bumble-foot," tumors upon the thighs, abscesses, and unnatural enlargement of the tendons or limb-muscles, are all local and accidental difficulties. Bumble-foot is caused by bruising the sole; and occurs with heavy fowls that roost too high up, and come clumsily to the hard floor or earth, in descending from their perches. It may be dissipated, if discovered in season, by active friction and

rubbing with strong liniment. If not, it will grow to an abscess which must be opened to the core, and healed up thoroughly afterwards, to save the fowl. But this occasional affliction is hardly worth the trouble it costs to cure it; and it can only be remedied so as to restore the afflicted bird to subsequent usefulness by seasonable treatment.

Rupture of the oviduct, or egg-passage, and enlargement of the lower intestines, either of which causes old fat hens of the heavier varieties to "break down behind" frequently, is a difficulty known in the experience of most poultry breeders. As we have elsewhere hinted, this is a vexatious affliction, where the hen is a good one, or a favorite; and it is hard to manage it successfully toward restoration. The difficulty may be alleviated, but it can scarcely be cured; since the occasion of the bagging down of the abdominal extremity of the bird is a gradual falling of the over-grown and over-fattened interior, which from its excessive weight and enlargement distends the parts outside of the *cloaca*, unnaturally; from which distention it rarely, if ever, contracts to its original shape again. The remedy for relief in this case, is to place the fowl at once upon extreme low diet; and first to starve off and reduce the excessive overgrowth of internal fat which has filled up the lower abdomen. After a few weeks the hen will resume her wonted uprightness in gait and appearance, and may come round all right again.

If the cause of her breaking down is *not* this kind of internal rupture, but proceeds from the accidental breaking of an egg, inwardly—as is often the case—though the outward indications may be similar, the treatment for this last-mentioned trouble is alluded to in another place. The two difficulties are quite different, in reality, and require altogether different management. We often see fowls, particularly half-grown birds, that sluggishly mope about, seek the sun's rays, close their eyes dreamily and half open the bill, at every breath they breathe. Otherwise they seem well, and in fair condition. Look to the birds directly, that exhibit these symptoms. If concealed *vermin* be not at work upon their skin and flesh—these indications are tokens of an approaching attack of roup.

Remove such bird or birds at once from the rest. Give the mustard, ginger, or rhubarb pills, for a day or two. Allow them for three or four days to drink no water that has not a dash of tincture of iron, or cayenne pepper in it. Feed low for a week, keep them dry and warm—and they will recover. "Scaly leg" is a disorder very unsightly, and afflicts old fowls, chiefly. The disease appears from the surface of the shanks, forms slowly, and is altogether parasitical. If permitted to mature, it grows into rough, greyish-white bunches, and terminates in sores. To cure it, commence early, and first wash the limbs thoroughly, in warm whale oil, or carbolic soap-suds. Then apply sulphur powder mixed with lard, as a salve, for two or three days. Afterwards cleanse, and finish with kerosene, rubbed on with a coarse flannel. The infinitesimal insects are thus destroyed, and the trouble disappears.

Moulting, or the annual feather-shedding of all birds, is described by some authors as a "disease." This is but a natural occurrence. Fowls are not "in condition" at this period, but they are not sick—in the true interpretation, at such times. They need better care, just then, nevertheless, since this is a critical transition; and good two or three-year old hens, kept for breeding stock, should be especially looked after, judiciously fed, kept away from the annoyance of the males, and they will generally pass through their moulting safely. These accidents or incidents occur in all poultry yards. But where fowls are properly tended, housed, and treated, far less of these complaints are heard, than upon the premises of the careless, indifferent, or reckless breeder. And it will be found by the humane, considerate, and kindly disposed keeper of this useful and interesting class of live stock, that a share of his attention given daily to the condition of his fowls, a watchfulness of their reasonable needs, and an eye open to the probable or possible *approach* of these troubles, will save him toil and money both, in his fowl-breeding experience.

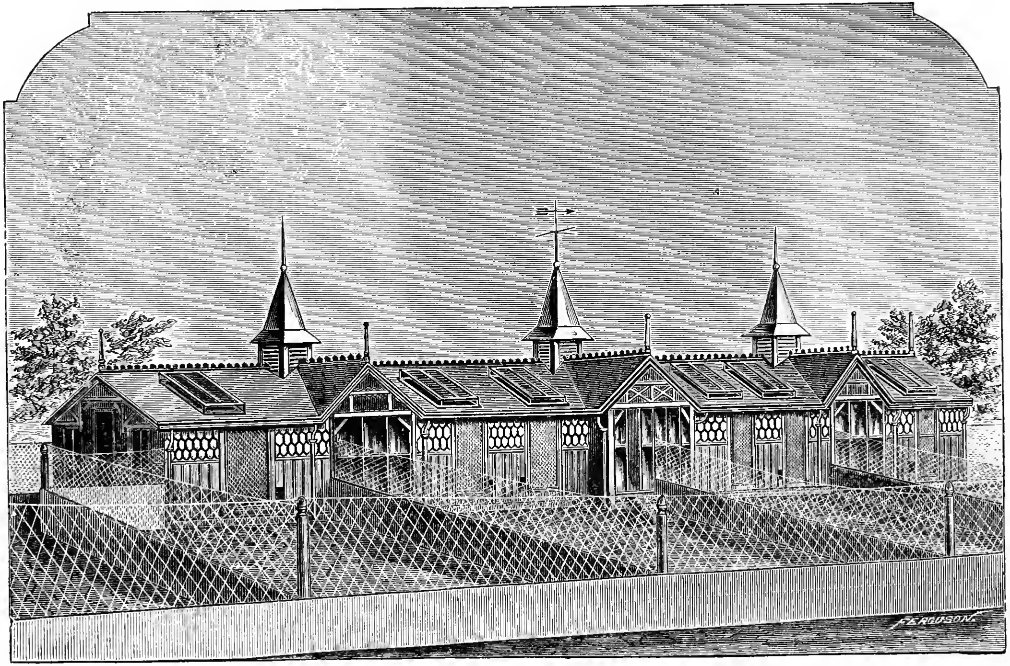
The large majority of the ailments of poultry referred to herein are directly traceable

for their cause to the errors and short-comings, carelessness, and inhumanity of those who are responsible for the unprofitable and unfortunate results attending their ignorance and indifference. The different diseases herein noted embrace all the maladies that are habitual among domestic poultry. If any other occur in the experience of American fanciers or breeders of fowls, they are *exceptional*—not generally prevalent. And we apprehend that if such exceptional cases are known, they may be readily traced to a correspondence with some one of the leading "diseases" herein mentioned; the *cause* for which will also be found to be similar to those which we have endeavored briefly but clearly to explain.

There is one important recommendation in ministering to these fowl-ails, which we have always found so necessary to average success in treating the invalids, that we feel constrained to insist upon its observance, for the common benefit of poultrymen and the stock. And this is that fowls should never be over-dosed. The less medicine given them—as a rule—the better they will be off, in the end. They need but very little in quantity, at any time, to operate on them to their advantage, or their destruction. It is easier to kill a good bird with over-dosing, than to work its recovery by judicious physicking. And many of the mineral and powerful medicines proposed by those who have never studied a domestic fowl's actual construction and constitutional habits, are utterly useless as remedies for their little ailments. So we repeat that the simplest remedials are always the best.

What we understand the nature of, and what we know will work in a certain way, regularly and effectively—such as sulphur, castor-oil, powdered rhubarb, alum, sal-soda, alcohol, camphor, cayenne, tincture of iron, garlic, etc., when properly administered, are the sort of medicines which should be made use of—and *not* the numerous chemicals and minerals advised by those who do not appreciate a fowl's composition, or natural formation. In a department prepared like this, for a work so extensive and embracing so many subjects, the space allotted for the full treatment of the subject of diseases of poultry is necessarily limited. But the writer has given his views upon the *leading* ails that fowls are subject to, and many hints contained herein will be found valuable to both fanciers and growers of poultry. It must not be forgotten that filth, cold, and wet yards, poor shelter, improper food, tainted drink, starvation, neglect, sunless houses in winter, or lack of shade in summer, close confinement, lousy nests, dirty floors, foul feed troughs, want of ventilation, etc., etc., are the causes of fowl disease, and death among them.

Reform this, altogether, or do not attempt to breed poultry, is our advice. And if the suggestions made herein towards the performance of the higher and better part in fowl-keeping be followed—we are quite confident that poultry breeders will be troubled very little with "diseases" among their flocks. With the nicest care and the best arrangements, however, fowls in American poultry yards and runs will inevitably get sick, more or less—as they will elsewhere. During the past few years, it has been noticeable that more complaints were current than ever hitherto, of ails among fowls. And this fact induced the author to prepare these pages, in a concise and complete form—limiting the article exclusively to the subject of diseases of domestic poultry. As we stated in the opening of this subject, it is important that we know clearly *what the matter is with our fowls*—when out of trim—before we begin to dose them. This being satisfactorily determined, we can then go about assisting them to throw off the disorders, and do this intelligently.




POULTRY HOUSE OF WM. GRAY, Jr., BOSTON, MASS.

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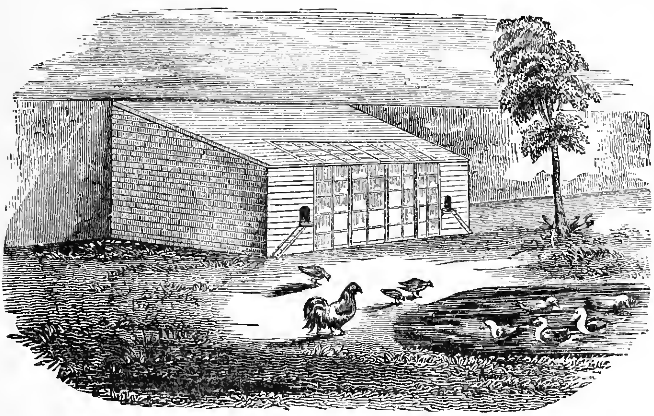
# POULTRY HOUSES.

IN order to attain success in poultry raising, a good substantial house will be necessary. It need not essentially be large or expensive, but should be warm and comfortable, and provided with ample means of ventilation and admitting the sunlight. It may be cheaply constructed of common boards, with the cracks well battened, and glazed sash of large size on the south side. Ventilation is best accomplished by having a cupola on the roof, under which may be a small door, or ventilator, opening down into the building. To this may be attached a cord so that the ventilator may be opened full or half-way, according to the weather and other conditions. Where the winters are very severe, it will be well to line the inside of the hen-house with tarred paper, or to lath and plaster it. The roosts should all be low, and on the same level, as fowls, like many of the human species in society, will be apt to quarrel for the highest perches. Large, heavy fowls should always have low perches, so that they can gain easy access to them. It is a good plan to have the roosts hinged to the side of the building, so that may be raised up out of the way when the house is cleaned out.

The different pens of the house should have a wire netting a part of the way above the board partition, to prevent the hens flying over. There should be feeding troughs placed against the wall of the house inside, and wired over to prevent the fowls from getting their feet into them. Feeding boxes that are self-feeding are very good for this purpose. It is also a good plan to have feeding troughs in the center of the yard, where the fowls may be

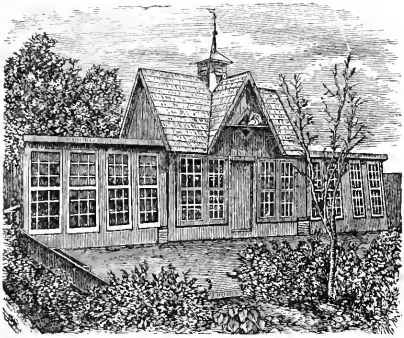


A CHEAP AND CONVENIENT FOWL HOUSE.

fed in warm, pleasant weather. These should be made stationary, so as not to be upset Pure water should always be kept where the fowls can have access to it at all times.

Various kinds of water tanks and drinking fountains for fowls are recommended. Those so arranged that they cannot be easily upset, or the water made filthy by the fowls, are the best. A three or four-gallon jug filled with water and turned mouth down, in a suitable dish, and properly supported, makes a very good drinking fountain.

Mr. George C. Brown, an extensive poultry breeder in Maryland, recommends that the floor of the hennery be never made of wood, as the droppings are absorbed to a certain extent, which causes an unwholesome odor, as well as dampness, both of which are very detrimental to the successful rearing of poultry. He says: "The proper way is to build a tight wall (cement or plaster), at least one foot higher than the earth, and fill it up with good, dry sand or earth. Constructed in this manner, the floor being so much higher than the outside earth, it is always in all weathers entirely free from dampness. Nests must be provided, and they should be made as secluded as possible. Have them quite dark. The hens like to go in a dark place to lay, and they are not as apt to get in the bad habit of eating their eggs, if nests are thus constructed. Where the house is made large enough to admit of it, it is a good plan to have a narrow room adjoining, and have all the nests made uniform in size, with a *bottom, sides,* and *one end.* They can be arranged on shelves, near the bottom of the room, placing the upper end towards the roosting room, so that the fowls can enter the nests from there. A board should be so arranged in the little room and hinged, that it may be raised up to gather the eggs from these nests."



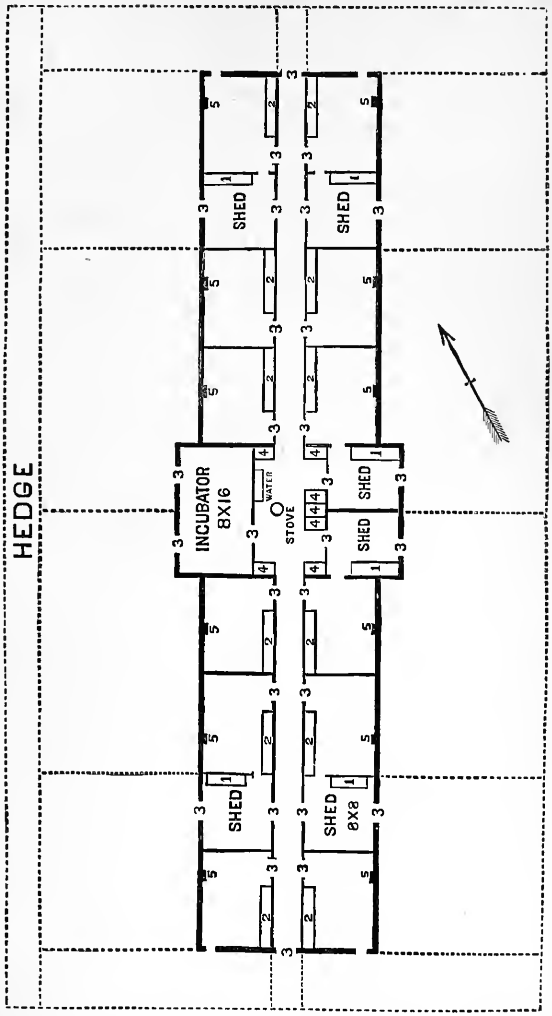
POULTRY HOUSE OF G. W. CHIDSEY, ELMIRA, N. Y.

The natural floor is, of course, the earth, but this is,—unless special pains be taken,—in almost any locality, too wet from the constantly rising moisture of the lower strata, and too foul from droppings, to furnish a wholesome dusting place, even if it were not too damp to be friable and dustlike. To obviate this, either a floor of sand, as above recommended, should be provided, or one of wood or cement. The latter is easily made and does not require the service of a mason, as many suppose. In any case, the floor of the hennery should be raised considerably above the level of the ground surrounding the fowl house. This is very important, otherwise the water after the rains and melting snows, will work its way in upon the floor, making it wet and causing bad odors, thus inviting roup and other diseases. If the building has no eave-trough and conductors, a ditch should be constructed around it to carry off the water.

Where boards are used for flooring in the poultry house, it should be thickly strewn with sand, ashes, road dust, saw dust, or other dry, absorbing material, which should be frequently cleaned off and renewed, in order to keep the surroundings as clean as possible. Always make ample provisions for an abundance of sunlight in the hennery; it will render the quarters much more healthful, and add much to the warmth in winter. Provide large dusting boxes, at all seasons, where the hens can have plenty of room to fill their feathers with dust. This will aid greatly in keeping parasites off; besides it is one of the methods by which the feathers are kept clean. Road dust, clean, dry soil, or ashes, are excellent for this purpose.

We give in this connection, cuts of several poultry houses, of different styles and sizes, adapted to the raising of a large or small number of fowls, from which many valuable hints and suggestions may be obtained by those desiring to construct a hennery.

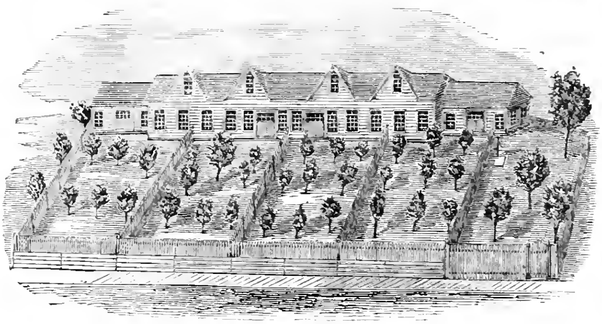
The accompanying cut of Mr. Gray's poultry house is scarcely a fair representation of the fine building the owner has devoted to his feathered pets, and which he breeds solely for the pleasure and recreation he finds in their care. It is situated on an estate which occupies eleven acres in the limits of Boston, on Howard Avenue. In order to give a better view of the house, the artist, in sketching, omitted the fine shade trees that add much to the attractive appearance of the grounds. The house is built of stone, with a lawn sloping from it on all sides which renders the drainage perfect, while it stands so as to face a little south of southeast, and thus secures the sun on both sides and end of the building during the day. Under the gables are the sheds, or what can be made open sheds by opening the windows, which are seen and represented as being open in the cut; the windows in the laying room being here represented by wire netting. The building is 100 feet long and 20 feet wide, with a hall-way 3½ feet wide running the entire length, as will be seen by the accompanying ground plan. It is divided into twelve rooms and six sheds for fowls, besides an incubator



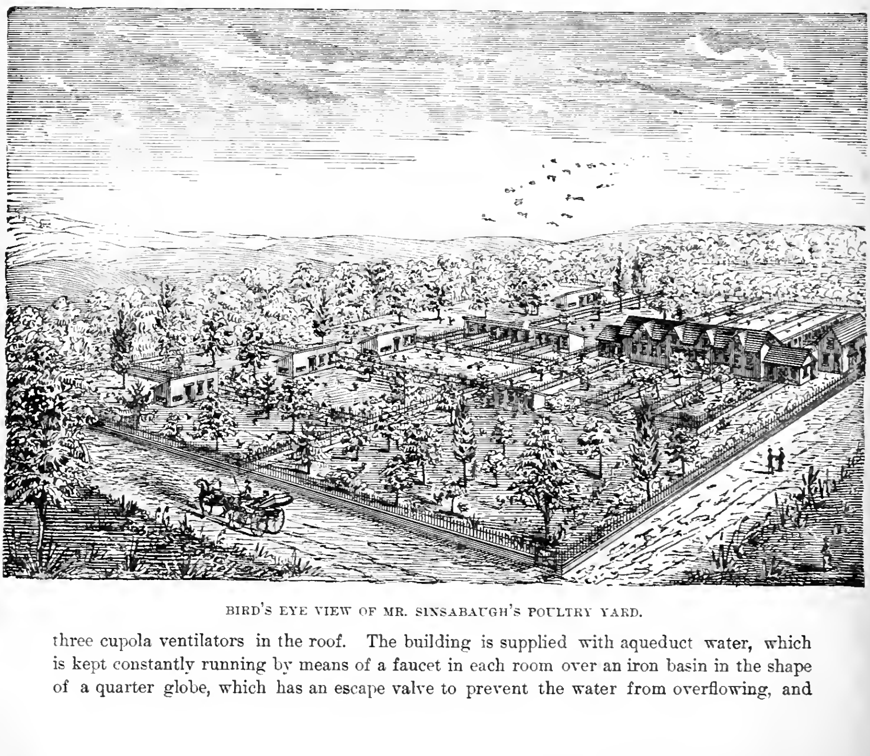

GROUND PLAN OF MR. GRAY'S POULTRY HOUSE.

room 8 by 16 feet, in which is an incubator of 360 eggs capacity, for hatching purposes. the interior finish we find hard pine floors, and hard wood for the studding or close partitions with plastered ceilings; while gas is used for light and also for heating the incubator and

cooking the food for the chickens. Heavy wire netting is used for the upper panels of all the doors, with doors opening on the hall, which latter is a convenience in collecting eggs from the nest boxes, No. 2. No 4 represents the locality of the grain bins, where is a stove which is used to keep out dampness and render the temperature comfortable in cold weather; here is also a sink with water etc. No. 5 represent the location of ventilators 5 by 10 inches, covered with wire netting to exclude all unwelcome intruders in the form of rats, bats, etc., and which supply the building with pure air, while the foul air has means of escape through the



POULTRY HOUSE OF L. E. SINSABAUGH, SYRACUSE, NEBRASKA.



BIRD'S EYE VIEW OF MR. SINSABAUGH'S POULTRY YARD.

three cupola ventilators in the roof. The building is supplied with aqueduct water, which is kept constantly running by means of a faucet in each room over an iron basin in the shape of a quarter globe, which has an escape valve to prevent the water from overflowing, and

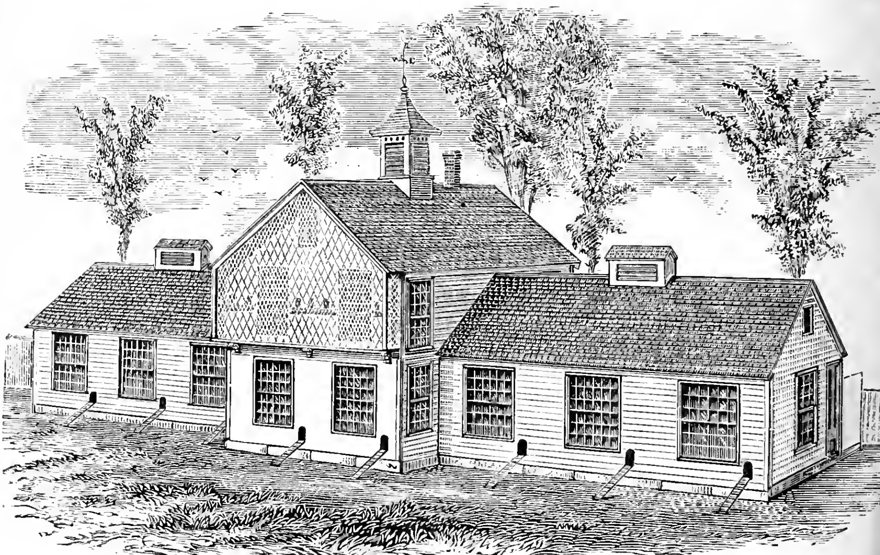
which furnishes the fowls with pure water constantly. No. 1 shows the locality of the several dust boxes where the fowls may take their dust bath *ad libitum*. The floors are kept covered with clean gravel to the depth of three inches, which adds much to the neatness, as well as the sanitary condition of the place. These pleasant quarters have for their favored tenants Light and Dark Brahmas, White, Black, and Partridge Cochins, ten occupying a single pen. We are indebted to the courtesy of the publishers of the *Poultry Monthly* for permission to copy the foregoing illnstration.

Although such a building as this will doubtless be more expensive than the majority of our readers would wish to build, yet a description of its plan will furnish valuable hints that may be available in the construction of a cheaper or smaller house for poultry.

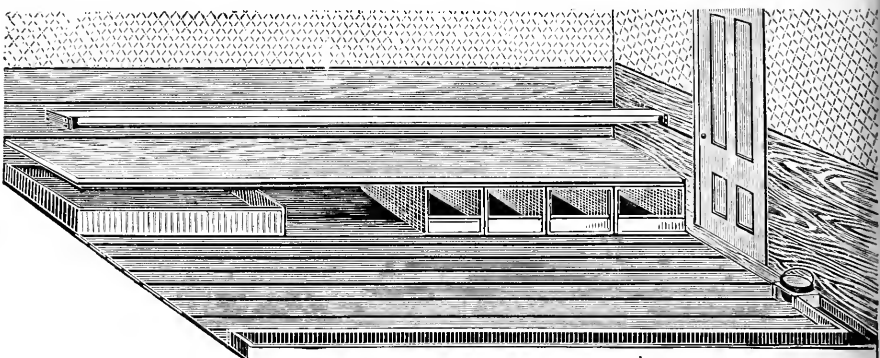
The preceding cut of Mr. Sinsabaugh's poultry house will doubtless prove interesting to both extensive poultry breeders and those keeping fowls in small numbers, as being very convenient and comfortable for the purpose. The building is one hundred and four feet long and sixteen feet wide; seventy-two feet of it being one and a half stories high. The upper portion or second floor is used for hatching purposes, and as a run for young chicks when the weather is too cold for them out of doors. The arrangement is such that each pen of fowls has a roosting room twelve feet square, a ground floor shed twelve feet square, besides two outside yards 24 by 60 feet, which are used alternately, the one being sown to oats which are growing while they are running in the other, thus keeping them supplied with green food. The sheds are valuable as furnishing a place for scratching in the dirt in winter, or as shade in the hot summer weather. A hall-way 3½ feet wide runs the entire length of the building, along the partition of which the nests are arranged in such a manner that they are entered from the rooms, each nest having a separate lid in the hall-way, so that the eggs can be gathered by passing along the hall, without entering the rooms.

Mr. Comey's poultry house, of which we give an illustration, is 64 feet in length. There are two one-story wings, each of which are 15 by 24 feet, the entire main floor being divided into eight pens, 8 by 15 feet each. The second floor is arranged for hatching purposes, the keeping of pigeons, &c., and is well ventilated from the cupola. From the second story there is a balcony 20 inches wide, from the edge of which a wire netting is attached in such a manner as to confine pigeons, and at the same time to provide them with an out-door run. The ground floor is well ventilated by adjustable ventilators on the ridge of the wings, and by a box in the center 20 inches square, extending to the cupola. An alley 3 feet wide runs through the building, which in the main part enlarges into a room 12 by 16 feet, in which is a stove for warming the building in damp or cold weather, grain chests, closets, stairway, etc. The partitions are 7 feet in height, including the four feet of wire netting at the top. Each pen has a perch located 8 inches above the center of a platform which is 28 inches wide and 16 inches above the floor, under which are movable nests and a dusting box. Both ends of the perches are supported by cast iron perch-cup holders, which are filled with kerosene, and by means of a wicking extending under the perch, from one cup to the other, the kerosene is drawn the entire length, and all the vermin are kept off. A feeding trough 3 by 4 inches, and 6 inches above the floor, runs the entire length of the pen on the side opposite the perch, which gives the fowls room to eat without crowding, while at the end of the pen there are boxes for ground shell, gravel, and a water-dish. Each pen has a window 4 by 5 feet facing the south, also a yard 8 by 66 feet, with a southern slope and containing shade trees. (There not being sufficient room in the cut for the representation of the yards, the artist omitted them.) The partitions between the yards are boarded solid from the ground to a height of 3 feet, above which a lattice work of 3½ feet extends. In visiting Mr. Comey's grounds we were particularly impressed, not only with the convenience with which his poultry house was arranged in all the minor details, but the gentleness with which he handled his fowls, and the entire absence of fear that they manifested toward him, he being able to pick any of

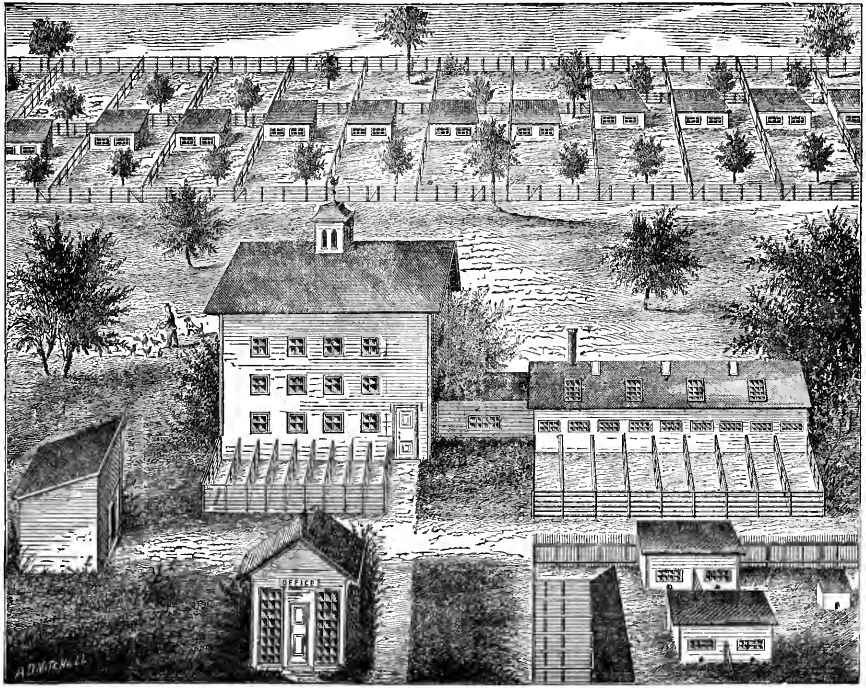
them up at any time as he chose, without the least resistance on their part. Fowls thus tame give unmistakable testimony of the gentle treatment they receive. Kindness towards animals and a love for them is a trait to be honored and admired, and a necessary accompaniment to the successful rearing of fowls, or any other of the domestic animals.



Poultry House of E. C. Comey, Somerville, Mass.

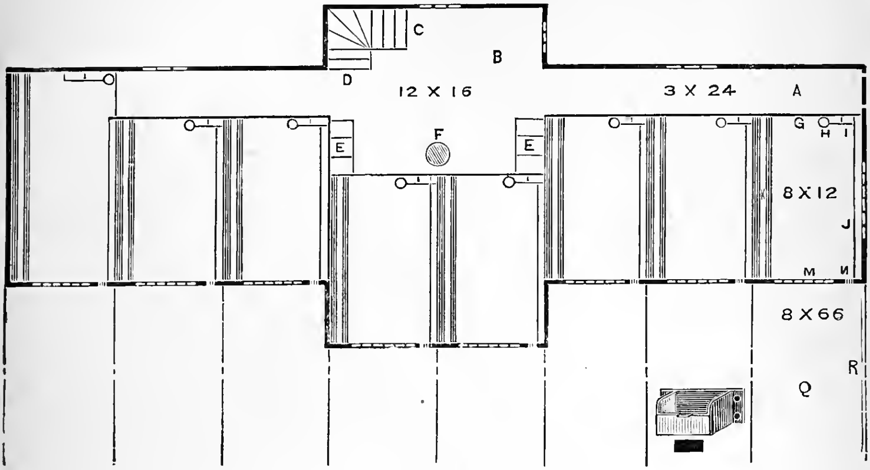


Interior View of one of the Poultry Pens.




POULTRY GROUNDS OF GEO. S. JOSSELYN, FREDONIA, N. Y. 1437

The following will explain the diagram of the ground plan of this building: A, Alley; B, Room for receiving, storing, etc.; C, Closet under stair; D, Stairway; EE, Grain chests; F, Stove; G, Door leading from alley into pens; H, Water-dish; I, Oyster-shell and gravel-boxes; J, Feed-trough; K, Perch; L, Platform to catch droppings; M, Large window; N, Hole opening into yards; O, Dusting-box; PPPP, movable nest-boxes; Q, Outside yard; R, Gate; S, View of perch cup-holder.



GROUND PLAN OF E. C. COMEY'S POULTRY HOUSE.

The accompanying cut represents the poultry buildings and yards of Mr. George S. Josselyn, formerly an extensive breeder of fancy poultry of various kinds.

The buildings, which are numerous, are so designed as to keep each breed entirely separate, from each other, and provide all with large rooms. The main building is three stories high, and is connected with a smaller house of one story by a covered passage-way, which contains a bin for grain on each side, a well, and the heating apparatus. Both buildings are divided by a hall running the entire length, and sub-divided into pens on each side. A run for each pen is found in front of both houses, and the smaller houses seen in the background are equally well arranged.

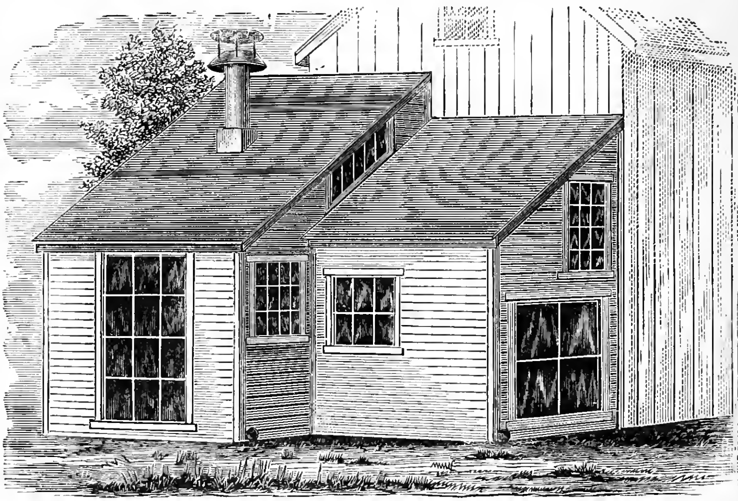
The poultry house of Mr. Chidsey is a neat and tasteful building with a gothic roof, as shown in the illustration. The center house is 14 feet by 16 feet, 8 foot posts. The wings are 14 feet by 16 feet, with 8 foot posts in front; roof descending to the back. The whole is divided into six compartments, and is admirably adapted for the rearing of different breeds of fowls, including a loft for a good collection of fancy pigeons.

The poultry buildings of Mr. Waugh represent a very convenient house adapted to a smaller number of fowls than those previously represented. The walls inside are of matched boards, tar paper being used also for the securing of additional warmth, while between the posts it is packed with saw dust. It is well ventilated at the top, the ventilator being in the center of the large building, and has an opening of 16 by 16 inches. The windows are double, to secure warmth in winter, and can be swung open or taken out in summer, and screen windows put in their places.

In the sleeping-rooms are tight board shutters, which can be closed in cold weather. The second floor is designed for setting hens and young chickens.

**Warmth in Poultry Houses.**—Warm poultry houses are very essential in winter, especially in a cold climate. The temperature will be largely modified by having an abundance of sunlight, which can be obtained with a southern exposure, and large windows on the south and east sides of the building. Additional warmth may be obtained by the use of double windows. A stove of some kind is a cheap and economic means of warming a poultry house. The temperature will be kept comfortable, and the place dry by this means. A coal stove is very good for this purpose, as it requires so little attention and keeps burning through the night. An oil stove is also very convenient for this purpose.

A recent writer gives his method of warming his poultry hen-house as follows: "Oil stoves offer a means of warming a house, which is both convenient and safe. If a trench be dug through the middle of the floor of the house, and a brick flue laid under the floor,



FRANK WAUGH'S POULTRY HOUSE, LOWELL, MASS.

connecting a shallow pit at one end, with a piece of stove pipe two to four feet high at the other—all inside the house—an oil stove having eight inches of wick for every 500 cubic feet of air, will temper the air of the house, so that in this latitude water will never freeze, provided the walls are reasonably tight. The shallow pit laid with bricks and cement, should be covered with a smooth flagging stone, and this with a board in case the stove gets very hot. The edge of the pit must be framed to protect it, and at one side of the stove a brick or two must be left out for air. This arrangement will warm the earth floor over a space a yard wide, and besides the warm air will issue freely from the pipe. Care is needed not to have the wick so low that imperfect combustion takes place, giving off bad odors. This plan of placing the oil stove under ground, is much better than having it exposed.

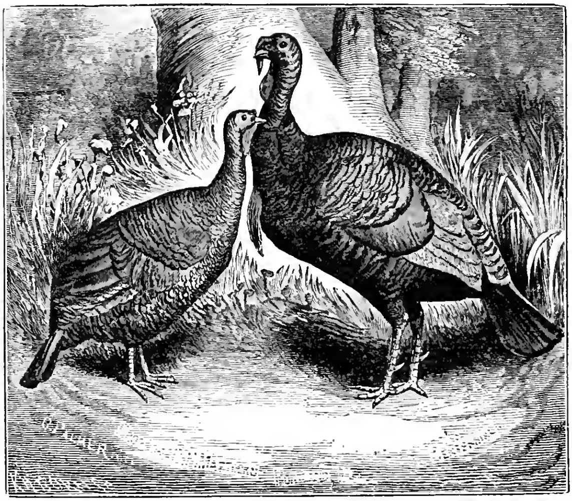
The whole expense of this way of warming is very little; if the stove be lit at 9 to 10 o'clock, it will be necessary only to burn it until sunrise, and a quart or so of kerosene will be all that need be consumed each twenty-four hours for warming a small house. It is desirable

that the temperature of a poultry house should never fall much below freezing. A warm house breeds vermin even in winter. The preventive and remedy for all kinds of lice upon fowls is dust. Into a little ashes, dry-slaked lime, and now and then a handful of flour of sulphur, may occasionally be thrown into the dusting box, and if the dust is kept clean and dry, and is fine enough, the whole house, roosts, nests, and all will be covered with it. Double glazing of the windows, or green-house sashes used in poultry houses, are a great advantage; and by this, a disagreeable dripping is prevented in cold weather."

A warm poultry house, combined with good food and suitable management, will be sure to result in a liberal supply of eggs during the winter. Besides, if the poultry house is not kept sufficiently warm, there will be a liability of the fowls having frozen combs, especially the single-combed fowls, such as the Cochins. We knew an old lady who had a very original device for preventing frost-bitten combs, and who kept thirty Leghorns, but whose hen-house was somewhat dilapidated and cold. Not wishing to have her pets disfigured with frozen combs, she made a flannel night-cap for each one, and regularly every cold night she visited the hen-house after the fowls had gone to roost, and put them on. It was a most comical sight to see these hens all in a row on the roost adorned with red flannel night-caps. Before the next winter, however, she had the hen house repaired, as the night-cap institution proved too troublesome to render its continuance profitable.

# TURKEYS.

THE domestic turkey is a descendant of the wild turkey of North America, or of a species of this race found in Mexico, and which differs from the former only by white being mixed with the tail coverts and tail. It is more than three hundred and fifty years since the turkey has been domesticated, yet, notwithstanding, it still retains many of its wild habits, even under the most favorable conditions for counteracting them. North and South America are the habitats of a separate species of this bird; and while that of the latter, also known as the Ocellated Turkey, has been domesticated to but a limited extent, the North American species has greatly increased and multiplied, having been domesticated and bred in all parts of the civilized world. All turkeys, whether of the wild or domestic varieties, breed freely one with the other, and continue prolific, thus proving conclusively that they were originally derived from the same species. The first writer who mentions the American Turkey is supposed to be Oviedo, who, in 1525, describes them under the name of peacocks, and comments upon the vast numbers found in this country at that time, their excellence as an article of food, etc.



BRONZE TURKEYS.
Bred by Gen. C. P. Mattocks, Portland, Me.

Lopez de Gomara published a book in 1553, in which he describes the wild turkey of America, calling them *Gallapavo*, and speaks of their flesh as being delicious. Pedro de Ciesa found them upon the Isthmus of Darien, Dampier in Yucatan, while Buffon and other later travelers mentioned them as seen in various portions of this continent. When the Spaniards conquered Mexico, they found the turkey in a domesticated state, and it is supposed to have been domesticated for several centuries before that period. This bird was introduced into England from America in 1524. It is supposed that they were introduced into France about that time, and into Germany from France about the year 1530.

In describing the native wild turkey Audubon says: "The grand size and beauty of this fowl, and its value as a delicate and justly prized article of food, render this the most interesting of the birds of the United States. The flesh is more delicate than that of the domestic turkey, and the Western Indians so value it, that they call it the white man's dish."

The plumage of the North American Turkey is very brilliant, of a metallic bronze hue, with a blending of colors such as black, green, bay, and brown. Like all of the feathered

WILD TURKEY.
Bred by W. K. Laughlin, Fort Dodge, Iowa.



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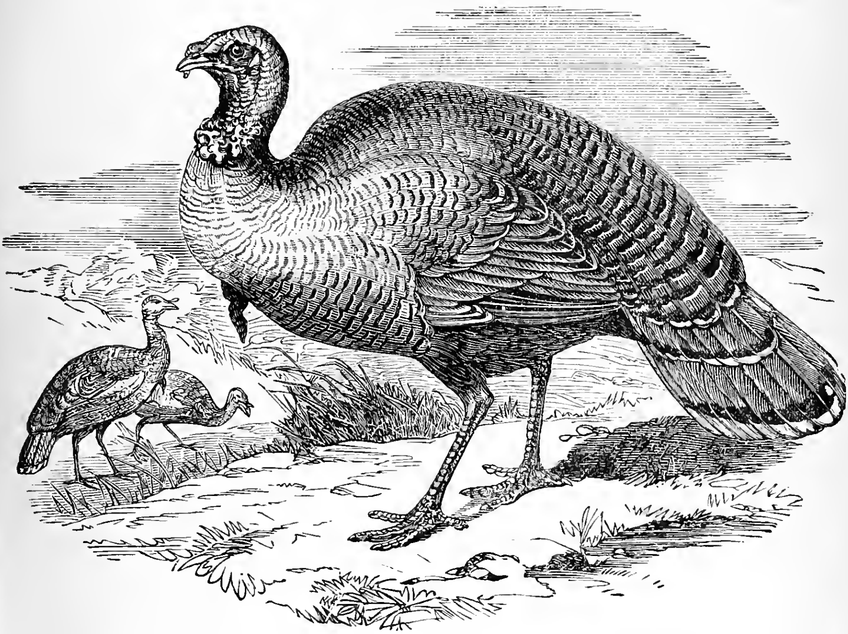
tribe, the cock is much more showy in plumage than the female. The Ocellated or South American wild Turkey is also very brilliant in plumage. The original wild species were black, bronze, and white mottled; but we now have them of any color, being bronze, black, buff, slate, white, etc.

**The Bronze Turkey.**—This variety of turkey has never yet had a rival, and probably never will have, with those who raise these birds for market, on account of their large size and hardiness. They are the largest and without doubt the best of the domestic varieties. The bronze variety was produced by a cross of the wild turkey upon the common turkey hen, the produce being improved by careful selection and breeding. The ground



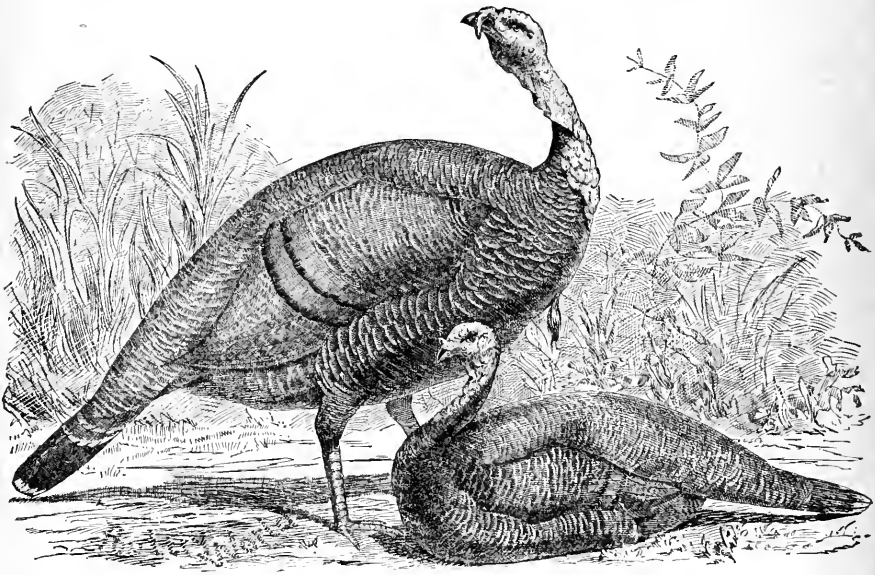
THE MAMMOTH BRONZE TURKEY.

color of this variety is mostly black, being variagated upon the wings and tail with brown, white, and gray, while nearly the entire plumage shows reflections in a bright light, of the most brilliant bronze, with rich and changeable colors.

The best specimens of this variety are described as follows: In the cock, the head, face, jaws, and wattles, are a rich red; the head long, broad, and carunculated; beak strong, curved, of a light-brown color at the tip, and dark at the base; eyes dark hazel, bright and clear. The neck, breast, and back, of a brilliant bronze hue, which glistens in the sunlight with a golden tint, each feather terminating in a narrow band, which extends across the end. The plumage of the under part of the body is similar, but somewhat less brilliant. The body should be long, deep through the center, and well rounded; the hind part well supplied with soft fluff.

The wings are large and powerful, the primaries black or dark brown, penciled evenly with bars of white or gray, secondaries smaller; wing bones black, showing a brilliant bronzy or greenish reflection in the sunlight; the wing coverts are a beautiful rich bronze, each feather terminating in a wide black band, giving a wide bronze band across the wings when folded; tail black, each feather being irregularly penciled with a narrow brown band, and ending with a broad black band, with an edge of dull white or gray. The more distinct the colors throughout the whole plumage, the better. The legs are long, and strong, and dark or nearly black in young birds, changing to a lighter color in older ones.

The hen turkey is somewhat less brilliant in plumage than the cock, but is really a beautifully plumaged bird. The skill and experience of our best breeders have been tested in bringing the bronze turkey to a very high state of perfection, and the thoroughbred bird of

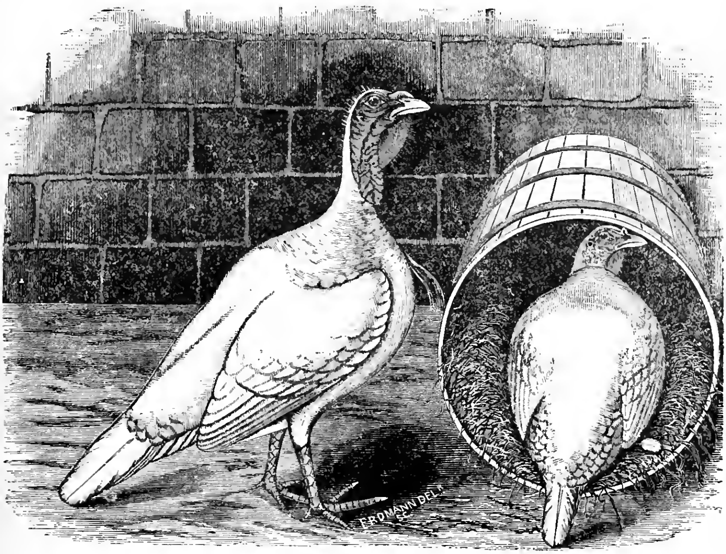


NARRAGANSETT TURKEYS.

this variety posesses certain fixed characteristics and qualities which will be reproduced in their offspring. The average weight of the adult bronze turkey cock is from thirty to forty pounds, when well fattened,—the hens from twenty to twenty-five pounds when fully matured. Young gobblers at eight months will frequently weigh from twenty-three to twenty-five pounds, and young hens from fourteen to eighteen pounds. These are about the average weights, although they are frequently exceeded in adult well fattened birds. They are good layers, and very hardy.

**The Narragansett Turkey.** — This is a variety very common in New England, especially in Connecticut, Rhode Island, and Massachusetts, where they have been bred for many years. Says a recent writer: "The Narragansett is an old acquaintance, and a very superior bird. He is one of our largest kinds, and is a very hardy fowl — raised to the

greatest perfection, perhaps, in the southerly portion of New England — which has long been specially known as a region where fine turkeys are produced. In the lower counties of Rhode Island and Connecticut — along the borders of the sea — enormous numbers of turkeys are raised annually, for the Atlantic city markets, or for family consumption in the large inland towns of New England, New York State, etc. And chief among this production has been the Narragansett Turkey — in later years improved upon by the introduction there of the Mammoth Bronze gobbler, which has increased the average size largely. The colors of the plumage of the Narragansett Turkey are black and white, mixed or splashed, so that they pass for a gray bird. But the feathering is uneven in hue, though it is claimed by those who have bred them extensively that, with proper selections and mating, they could with care be bred to a feather in color."



WHITE HOLLAND TURKEY,
Bred by Benson, Maule & Co., Philadelphia, Pa.

The color of the plumage in the most perfectly marked birds is a metallic black, each feather ending in a broad, light steel-gray band edged with black; wings, black or dark-brown penciled across with white or gray bars; wing bows metallic black with considerable bronze lustre; tail black, with irregular penciled bars of brown, each feather ending in a broad, black band edged with light-gray. Shanks long, strong, and deep salmon or brown in color; color of beak, light horn. This variety is thought by many to be more tame and domestic in its habits and less inclined to roam, than some others.

**The White Turkey.**—This variety, sometimes called the White Holland Turkey, is not as commonly seen as the bronze and some of the other varieties. It is also not so large or hardy as the bronze variety, but is very attractive, having a pure white plumage, which forms a pleasing contrast with the bright red and blue white caruncles of the head and neck, and the glossy jet black tuft on the breast of the cocks. Its flesh is white and juicy, and its

downy thigh feathers are valued in the household. They are good layers and excellent mothers, generally mating quite early. They are not, however, bred very extensively in this country, as the bronze and some of the other varieties are much larger at the same age, and at maturity command a higher price in the market.

**The Black Turkey.**—The black turkey is more commonly bred in this country than the white, and is generally regarded as more hardy than the latter. It is bred in France more commonly than any other variety. The pure bred birds of this variety have a plumage of a rich metallic black,—the color of the legs a dark lead or slaty black. Among the common domestic copper-colored birds, many will be found of a dark color, nearly black, but these are only mongrels. Adult cocks of this variety, weighing less than twenty pounds, and hens weighing less than twelve pounds, are considered disqualified for the show-pen.

**The Buff Turkey.**—This variety is also considerably smaller than the Bronze, but will average about the weight of the white and black varieties. It is quite common in the United States, being frequently seen upon the farms where turkeys are raised. The color of the plumage is a clear buff throughout; the legs of a bluish-white or flesh color. The plumage of the hen is similar to that of the cock.

**The Slate Turkey.**—This bird differs from the three preceding varieties described principally in the color of its plumage, which is throughout of a very handsome slaty or ashy blue. The legs are light or dark blue. It is very rare, being seldom represented at our poultry shows.

**The Crested Turkey.**—This is an exceedingly rare bird, and may be regarded as quite a curiosity in the turkey family. Main says of it: "Although not of very recent date, the subjugation of turkeys has already produced marked varieties in our climate. The most remarkable is that of the tufted (or crested) turkey, as yet very rare, and whose tuft is sometimes white, sometimes black in color." A turkey of this variety, and from which the accompanying illustration was made, was exhibited a few years since at a New York poultry show, and attracted great attention. Temmick speaks of this bird as a "sport" only, and differing from the American wild turkey merely in the provision of a crest or tuft. In breeding, the crest is not always reproduced in the progeny, although with care in selection, for this object, this feature could probably become a marked characteristic, if desired.

**The Ocellated Turkey.**—This is a native of South America, where it is now found in a wild state. It breeds well with our domestic turkey, and the progeny is quite fertile, but it seems best adapted to a warm climate, both the pure-bred fowls and cross-breeds being too tender for our severe Northern climate; hence, it is unknown as a domesticated bird in the United States and Europe, although it was domesticated for centuries in Mexico before the conquest of that country by the Spaniards. It is the most elegant and brilliant in plumage of the whole genus. The ground color is bronzed green, banded with gold bronze and glossy black. Low down the back the color is deep blue and red; upon the tail the bands become fully defined and sharp, producing the peculiar ocellated or eye-like marking which gives the name to this species. The wattles are also very peculiar, and the head and upper portion of the neck are covered with wart-like protuberances, as shown in the cut on page 617.

**General Management of Turkeys.**—To those who understand the proper method of rearing turkeys, and have the necessary appliances and conveniences, it is not a difficult thing to accomplish, and always proves a profitable business when skillfully managed. In order to attain the highest success, considerable care and skill are essential, together with a knowledge of the habits of this fowl. In rearing large, strong turkeys, much depends upon the selection of the breeding stock. Farmers are generally very careless and indifferent in

CRESTED TURKEY.

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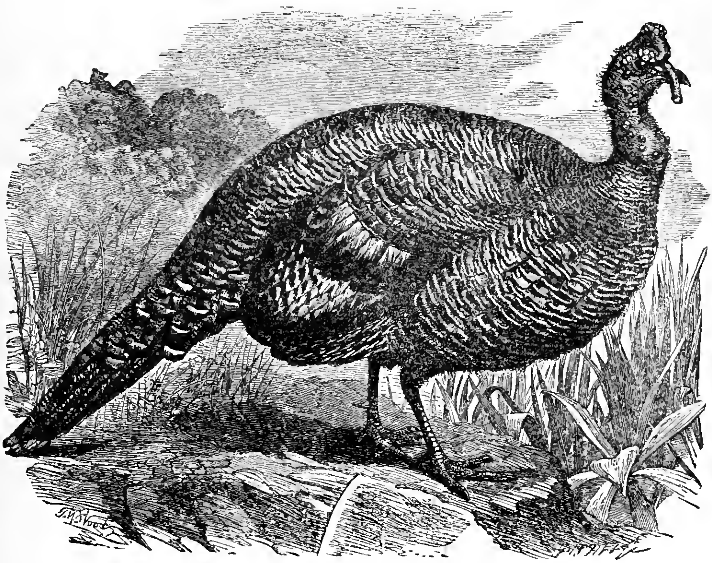
this respect. It is too frequently the practice to sell off the largest and heaviest birds about Thanksgiving and Christmas time, and retain the late birds of inferior size for breeding purposes. This is a very grave mistake, for with fowls, as with horses, cattle, and other domestic animals, the best of matured parents should always be selected for perpetuating the stock. Another very objectionable practice is to breed only from yearling hens, the old birds being sold off under a mistaken idea of economy because they will weigh the heaviest. It should be remembered that the turkey does not attain its full maturity until the third year, and the largest and strongest chicks can only be secured from matured parents.

Turkeys will not bear confinement well, and must have plenty of range in order to thrive. They are impatient under restraint, and retain a love for roving,—a trait of the wild bird that has never been subdued or bred out by domestication. This roving disposition is the chief objection to raising them unless there is plenty of range for them to forage in, as



OCELLATED TURKEY.

they are liable to do much damage in gardens and cultivated fields. After the hens have fairly commenced laying they become more quiet, and are less inclined to roam, until they have the care of their young broods.

It is the custom with many successful breeders to remove the cock from the flock before the hens commence sitting, as he often does much harm when a nest of eggs is half hatched through his stupid and persistent attentions. Old turkey hens are more reliable as sitters than young ones, although it is thought by some that young birds are less liable to steal their nests, than old ones, and thus considerable trouble and loss may be obviated from the depredations of foxes, skunks, hawks, and crows, which latter are known to be great foragers on eggs. Turkey hens are generally good sitters, but are sometimes uncertain in this respect. A Cochin or Brahma hen is frequently used for hatching the eggs of turkeys, especially those

first laid. When the first eggs are to be used under a hen, they should be removed daily, and be cared for particularly in the chilly nights of spring.

A poultry breeder of considerable experience says: "All the first lot of eggs received I placed under hens for hatching, and you will find that the turkeys will have finished their second laying a few days before the hens have finished hatching. I then take the eggs from the hens and give them to the turkeys, and sometimes the turkey has only to sit a few days when she has her young If I am compelled to leave some of the eggs with the fowls to bring out, I deem it an indispensable requisite to see to it that the hen is perfectly free from lice, using pulverized sulphur, etc., freely. I regard it as next to impossible for hens to raise young turkeys, for turkeys are exceedingly tender when young, and above all things they must be kept free from the parasites that infest the common fowl. They must not even be allowed to remain over night about the same building where the common chickens are kept. Do not be afraid of putting as many as forty or fifty young turkeys with the old mother turkey, but keep them in a dry, warm place, especially over night."

**Nests for Turkeys.**—Turkeys are very apt to steal their nests, being sly in their habits, and retaining considerable of the wild blood that has never yet been bred out, and perhaps never will be. It is therefore a good plan to make places frequented by them, and out of the way of intrusion, attractive in this respect, by placing in the corners of the fences and yards a few pieces of boards set up on end with a little straw or dry leaves behind them and a china egg half secreted in the rude nest, thus decoying the bird into laying in the nest and places selected for them. There is no necessity for making an elaborate nest; it may be fixed in a shady clump of bushes, in a thicket on the bare ground, or an old barrel or box may be turned on its side and placed on the ground among some bushes, thus providing shelter from the storms, and a secure hiding place so much coveted by the turkey.

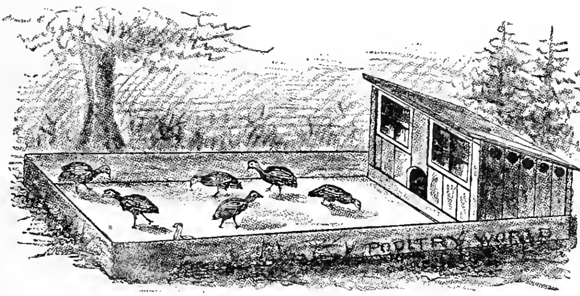
A hen turkey will lay from twelve to eighteen eggs before manifesting any inclination for sitting. When she wishes to sit, she will be found constantly upon the nest where her litter has been laid. When it is desired that she should lay farther before sitting, as soon as she is found on the nest over night, take her off and put her in a coop in the yard frequented by the rest of the flock and let her remain about four days, in the meantime giving her a liberal supply of food and water. About the fourth day she can be set at liberty again, and in five or six days afterward she will commence laying her second litter. When turkeys are used for sitters, it is well to place food and water by them daily where they can help themselves, as they are not apt to leave the nest often for this purpose. Several hens should be set at the same time so that the chicks of two hens may be given to one mother to rear.

A good authority says on this subject: "One turkey will take care of thirty young with as much ease as she manages half of that number. The hen that is released from maternal cares will very soon lay again, and hatch a second clutch. In setting the hens they should not be near to those that are to hatch later. They will sometimes abandon their nests to help take care of the young chicks that they hear near them. If the neighborhood is infested with vermin, it is desirable to remove them to the barn, or some outbuilding, where they can be protected. This requires a little strategy that is easily accomplished with birds that are thoroughly domesticated. The turkey should be allowed to sit on artificial eggs for a while. Then the new nest under cover should be a coop of some kind into which she may be securely fastened. The bottom should be about three feet square, and furnished with straw for the nest. Remove her to her new quarters in the evening, and fasten her upon the nest until the second morning. Then provide food and water, and remove the fastening and let her come off to feed. For the first time that she comes off, she need not be let out of the building. After this, if the door is left open, she will ordinarily go back to her nest as securely as if she were brooding out of doors. They are close sitters, feeding with great haste, and dusting themselves, and hastening back again to the nest. They brood their eggs for four weeks, but

sometimes it is prolonged a day or two. As soon as the chicks peep through the shell, the mother makes it known by a peculiar plaintive sound unlike anything heard from her until she has this new-born joy. A turkey will almost always hatch the larger part of her eggs, frequently every one. Sometimes the hatching goes on so rapidly that you find a whole nest of chicks before you suspect their appearance at all."

**Care of Young Turkeys.**—Like young chickens, the turkeys when first hatched require no food for twenty-fonr hours at least, and if not fed for thirty-six hours after hatching, they will not suffer, the yolk of the egg furnishing sufficient nutriment for the young birds for that length of time. They are, however, not as strong as newly-hatched chicks. in fact are exceedingly delicate, and should not be handled, but left entirely to the care of the mother hen. When about thirty-six hours old, they should be taken with the mother to a pen (which should be ready for them), and fed with hard boiled eggs chopped fine, and stale bread or cracker crumbs moistened with milk. Unless suitable food be given them at this early period they will be liable to die; a newly-hatched poult being the most feeble and tender of all domestic fowls.

They should also be fed regularly four or five times a day for the first two weeks, which will give them a good start. They eat but very little, and want it often, and nothing should




PEN FOR TURKEY POULTS.

be left over to become sour or mixed with the excrement. Never put the food where it will become mixed with dirt. The foolish practice, so tenaciously adhered to by old housewives, of making the young poults each swallow a whole peppercorn to make them healthy, is now generally discarded, such a diet being about as indigestible as a piece of lead. The mother bird should be fed all she will eat of corn meal ground coarse and mixed with milk, also grain, and be supplied with fresh water. They should be confined in a pen on a grass plot for about two weeks, until strong enough to accompany the mother, who will be liable to take her young brood on long rambles when they will be lost in the tall grass or grain fields, or become too tired to follow her, unless this precaution is taken. In such cases the little chicks find it impossible to keep up with the mother who soon gets out of hearing, and they perish for want of food and covering. Carelessness in this respect and exposure to wet before being fully feathered is the cause of more loss to turkey raisers, than all other causes combined.

A recent writer on turkey raising says: "There is no doubt but that the chief cause of the mortality among young turkeys is their exposure to wet before they are fully feathered. The ordinary turkey-raiser trusts a good deal to the instinct of the mother turkey, and the mother turkey, if left to herself, squats down just where night happens to overtake her; gets

up early in the morning and wanders around in the wet grass in search of food, and as a natural consequence more than half of her brood die of chills and cramps before they are a month old, and more than likely the other half is gobbled up by some four-footed prowler. Dew is about as fatal as poison to the young turkeys before they are fully feathered, and if you expect to raise your turkeys, and make the rearing of them profitable, you must keep them out of the grass when it is wet with dew, until they are about two months old. I have a large, well-lighted, gravel floored shed, where I can confine my young turkeys in the morning until the sun has dried the dew off the grass, and on many rainy days they are kept in the house all day. The mother hens are confined in slat coops placed along the rear of the shed. Where one raises the turkeys in large numbers, I think some such arrangement would pay, but the ordinary farmer who raises only a few dozen for market each year, would not care to go to the expense of putting up such a building."

After the first week or two, the egg and bread crumbs may be discontinued, and scalded corn meal mixed with skimmed milk and boiled potatoes may be given. Onion tops chopped fine and mixed with the mess, are also excellent. Grass, cut fine, or cabbage finely chopped, may also be given for green food. About twice a week a little Cayenne pepper should be put in their water or mixed with their food, as this aids digestion, and promotes warmth. The best way to prepare it is to make a tea by turning hot water on the pepper. By this means the pepper will be more evenly distributed among the whole flock, than if mixed in a dry state.

Sour milk or that turned to curd is also excellent for young turkeys. The whey may be drained out with a cloth strainer or colander, when the curd will be in a crumbly condition. Never scald the sour milk, as this will make the curd too tough and indigestible. Boiled liver or meat given every other day, will make them strong and quicken their growth. Never leave salt where they will eat it; carelessness in this respect might be the means of greatly diminishing the number of the flock. In salting cattle in pastures, and turning out old brine from meat and fish barrels, those who raise turkeys should be sure to see that no such refuse is left in places frequented by these birds. As the birds get older, cracked corn, wheat screenings, and buckwheat, may be given. All kinds of grain are relished by the half-grown turkey, such as Indian corn, with occasionally wheat, oats, buckwheat, and barley, for a change in diet; corn is, however, the best as a staple food for turkeys during the year. Animal food should be given occasionally, such as meat or meat scraps. Fruit and vegetables, cooked or raw, are also relished by them. Turkeys should always have access to coarse gravel, crushed oyster or clam shells, as well as pure water.

General C. P. Mattocks, of Portland, Maine, gives us his method of managing bronze turkeys as follows: "The true method in breeding Bronze Turkeys is, to begin with a trio of birds from the yards of some reputable and skillful breeder. If possible, let the hens be from eggs laid by one and the same hen turkey, and fertilized by means of the same cock turkey. The little chicks, for at least two weeks, had better be kept in a small, dry yard, and fed on boiled eggs, etc. The eggs may be hatched under hens or under turkeys, but turkeys are better as mothers, because they take their young on long tramps and thus enable them to get better food and more hardihood. At no time should young turkeys be allowed to go loose in the morning until the dew is off.

For morning feed, after two weeks, warm meal and boiled potatoes are good, with wheat screenings scattered over the ground. The warm feed should be given three times a day for the first two months, with cracked corn at night. As the turkeys grow old, the number of feeds may be decreased and whole corn substituted. Where there is no danger from foxes or other enemies, the old turkeys may be safely left to 'steal their nests,' and no one need visit their nests until the usual four weeks have passed, when, as a rule, the old turkey will leave her quarters for home with a fine brood of little ones. The size of Bronze Turkeys depends much more upon feeding while young, than most persons think. The breeder who

is earliest among his chickens and young turkeys in the morning, is the one who usually takes the 'lion's share' at the fairs.

If any symptoms of rheumatism appear, a frequent feed of red pepper sprinkled in the hot dough. will, with warm quarters, generally cause a change for the better. The greatest care must be taken in the selection of males, and, as with all other kinds of poultry, but perhaps in a more marked degree, careless breeding and a failure to kill off the unworthy birds, soon destroys the beauty and symmetry of a flock. Never mate brothers and sisters, but a *good* sire may be employed with a good daughter safely. If the turkeys can have good range in summer, and are hatched as early as July 1st, the business can be both pleasant and profitable. The Bronze Turkeys are wonderful for their good behavior in the matter of coming home nights. They are great wanderers, but never get lost, and do not, like the common turkey, wear one's patience out with hunting for them when night comes."

In southern New England where large numbers of turkeys are raised annually, it is the custom among many breeders of this bird, when feeding uncooked meal to them, to mix a small quantity of clean seaside sand with it, when mixing it with milk or water. This, it is claimed by those practicing the method, acts like gravel in aiding digestion, but it is also claimed that this mixture should not be fed later than three o'clock in the afternoon, for if fed towards night, it will lie heavy in their crops during the night, and prove injurious. A breeder of turkeys from Rhode Island claims to have lost but two birds out of a flock of four hundred and fifty-four raised during a single season, by this method of feeding. The quantity of sand used in this case was about one-sixth that of meal.

**To Prevent Lice on Young Turkeys.**—Wash the old turkey when taken from the hatching nest, with a decoction of tobacco, on the under side of the wings and on the body, but do not permit any to get on the young chicks. Put also an ointment made of yellow snuff and fresh lard under the wings, and on different parts of the body. If the young turkeys get lousy, put the same ointment on the top of the head, under the wings, and naked parts of the body. It is also a good plan to mix a little sulphur with the dough occasionally, which will be distasteful to the parasites. When young turkeys act sleepy and seem drooping, it is a pretty sure indication that vermin are troubling them, and it will pay to examine every bird, and take all the necessary precautions.

**Shelter for Young Turkeys.**—An extensive poultry raiser in southern Connecticut, says: "If you mean business in raising this crop, see that the hen and her brood are safely housed every night for a month at least after hatching. A vacant stable, or shed, or barn floor, or hovel, furnishes suitable shelter, and with little trouble after the habit is established. The prime object of this shelter is to guard the young against water and other enemies. Showers often come up in the night and drench the mother-bird, and if she attempts to move, some of the young will be drowned. Then, in the open field, they are exposed to skunks, foxes, and weasels, and sometimes to thieves in human shape, who can bag your birds at midnight, and remove them to unknown parts. Then the young chicks that roost on the ground for the first month, are more likely to have straight breast bones than those that take to the roost and balance their bodies on a fence rail, or the small limb of a tree. The birds get accustomed to go into the barn and other buildings, and it is much less trouble to yard them in the fall or winter, when you want to sell them for stock or for slaughter."

Another writer follows a different method, and confines the young poults in a pen for about two months, after which they are set at liberty, and with the mother bird are permitted to range at will. He says: "The turkey poult pen is a necessity while the young ones are coming up from the shell to six weeks old. This is a very simple contrivance, such as has long been in use among our best turkey breeders in late years, and which has been found both practical and highly useful. This pen is constructed by placing a board on edge, say

fifteen inches high, on three sides, oblong square, eight or ten feet by five. The rear is occupied by an upright, slant-roofed box, three feet by five, boarded tight, with a few holes at the eaves for ventilating it when closed up. Entrance to this coop is made inside the boarded pen, front of which may have a latticed or wired door, to be shut at night for security against prowling vermin.

The height of boarding described will confine the poults until they are six or eight weeks old, and the mother will not leave this pen because her young ones are unable to mount the barrier. It is an excellent arrangement for the poults, and keeps them dry and comfortable when they most need to be free from the rains or dews and dampness of the grass or open fields. Nothing is so pernicious, and to no cause can the mortality among turkey poults be assigned so directly as to their exposure to wet in their young days. This is what it is that frequently destroys them, and to the careless method too often adopted by the ordinary turkey raiser of allowing his little flocks to run about loosely in the early morning hours may be attributed more than half of all the losses experienced in the early season of the year which are so commonly complained of.

Confine the poults to such a pen, strictly, during the first two months of their lives. Feed them upon such food as we have described. House them at night, out of the heavy dews, in the way we have now directed, and protect them from the sun as well, and you may succeed in rearing five-sixths of all the young turkeys you can get hatched, ordinarily from April to June, annually. After two months old, the young ones may be set at liberty, and allowed to follow the roamings of the hen mother. It is well at first not to let them run at large while the dew is upon the grass. This chilly wet is an enemy to the tender young birds always, and occasions cramps frequently when exposed to the dampness alluded to. They will gather in the pastures and fields during their daily wanderings fully one-half of all the sustenance they need. Feed them in the morning before they start away, and at night they will eat heartily of the grain supper you provide. And all of them will "come home to roost" at evening. Accustom them to this daily good cheer at nightfall and they will always be on hand seasonably to partake of your hospitable bounty.

But if they fail to return at first, they should be brought home every night with as much regularity as the cows, and it should be the business of some one to count the broods, and see every bird on the poles. If this habit is formed early, it will require very little time to attend to them. They will come regularly for their feed at night, but after a time this will not be necessary. With a good range they will pick up insects enough to keep them in good thriving condition. Dry summers are most favorable for them. Insects, especially grasshoppers, abound, and they lose no time in foraging. From June to September they will in the main take care of themselves, and benefit the farm by the havoc they make among the insects. They will 'shoot the red' at about three months or less, and after this and their early moult, they will grow well if fed well, and come to maturity in good season profitably."

**Roosts for Turkeys.**—Turkeys are usually left to seek roosting places on trees or buildings, but this is a negligent practice; a place should be provided for them for roosting, the same as for hens. Mr. W. Clift, of Connecticut, an extensive breeder of turkeys, says: "Nothing is more common than to make the turkeys roost upon apple or shade trees near the house or barn, or even upon the shed and barn roofs, or other farm buildings. But this is a slovenly practice, and open to several objections. The roosting of the young birds upon small limbs is liable to injure the breast of the chicks while they are in the gristle stage of growth, and in zero nights the feet of adult birds are much more liable to get frozen upon a small limb than upon a stout pole, broad enough to balance the bird without clasping. The toes are more completely covered with feathers and protected from the frost. The roosting of birds upon the roofs of buildings is a filthy practice that no thrifty farmer should tolerate. The manure is necessarily wasted. A properly constructed and located roost guards against

these evils, and makes an important addition to the manure heap. The wild turkey, of course, lodges in trees during the winter, but she has the choice of location, and seeks the shelter of thick woods, which modifies the temperature.

One of our best poultrymen, who raises some two hundred turkeys yearly, has located his roost at the south end of his horse barn, where there is partial shelter from the northeast and northwest winds in winter. Forked posts form the support of the scaffolding—two front posts about eighteen feet high, and two rear posts about fourteen feet high. The front and rear post at each end of the scaffold are connected by a stout heavy pole four or five inches in diameter, kept in place by the forks at the top of the posts. Upon these side poles which slope like the roof of a shed, smaller poles three or four inches in diameter are spiked at each end, forming the roost for the turkeys. These roosting poles are about two feet apart, of red cedar, and are very durable, with a strong odor, which is said to be a safeguard against insects. The white cedar of the swamps, or the arbor vitæ, or any of the resinous woods would answer the same purpose. A board is put up at the lower side of the scaffold, and the young turkeys mount the roosts by this board until they are old enough to fly.

The advantages of such a roost are the following: There is a fixed place for the birds, where the person who has the care of them can look for them at morning and evening, and learn by counting if any are missing, by straying or by theft. By putting a few loads of peat, muck, or headlands under the roost, and adding to it occasionally, an excellent compost can be made. The food of turkeys is grain, and in summer very largely insects, and the droppings are rich in nitrogen. Any thrifty farmer will understand the value of this item. The scaffold, being fourteen feet high, is protected from foxes at night, and the turkeys are much less liable to be stolen by thieves. Turkeys that roost upon fences by the wayside, or upon apple trees, are very tempting to low bred people with indistinct notions of the eighth commandment. On the roost turkeys can only be approached by a ladder. In the zero nights of winter, if the roost has the shelter of a building, or of a belt of evergreen trees, the turkeys are saved from frost bitten feet."

**Crooked Breasts.**—A distortion of the breast-bone is occasionally seen in all poultry, giving the fowls a deformed appearance, but more frequently, perhaps, in turkeys than in barn-yard fowls. It is an indication of a weak constitution, or of an injury received while the bird is young, such as sitting on improper roosts, such as small limbs of trees, etc. The writer had a valuable Brahma cockerel become deformed and useless for breeding purposes by sitting on a roost that was not horizontal, one end of which was considerably higher than the other. This deformity is sometimes occasioned by too close in-breeding. When this is the cause, change either the cock or the hens. Never breed from deformed birds; they are only fit for table use, such deformity not injuring the flesh at all, but would be likely to affect the market value.

**Fattening Turkeys.**—Turkeys should always be sent to market in prime condition. The true economy in feeding turkeys is to give the chicks all they can digest of good food, from the time they are out of the shell until slaughtered, which is generally in about seven months. Turkeys that have an extensive range will pick up considerable food in this way, but they should be fed at regular intervals during the day. They should be put upon a regular course of fattening as early as the middle of October when the birds are to be ready for Thanksgiving. The smaller birds should be reserved for Christmas and New Year's markets, as they will continue to grow very rapidly, and will well repay the expense of longer feeding. The basis for fattening food for turkeys should be old corn, either as grain or cooked meal. Warm cooked meal mixed with boiled potatoes is an excellent diet to feed occasionally.

The rations in the morning should be warm food. Always have plenty of feeding room in troughs, so that all can have a chance to get all they wish, with no crowding. and feed just what they will eat up clean. Milk is excellent in fattening. New corn will be liable to make the bowels loose, and is not as good for fattening turkeys as the old. When the bowels are loose, scalded milk with a little cayenne pepper sifted will generally correct the evil. On some turkey farms, where the birds are raised in large numbers, the birds are kept in a enclosure of two or three acres, and a supply of corn and water kept constantly by them, besides feeding once a day with cooked meal. A reliable gentleman informs the writer that in raising a flock of about five hundred turkeys, it was his practice during the fattening season to turn from eight to ten bushels of corn on the clean grass in long rows across the field, and permit the birds to help themselves, replenishing the supply when it became exhausted. The range was so large that the food would not become contaminated with their excrement, and having a supply of food at hand the birds did not range much, but lay about idly and fattened all the more readily.

**Preparing Turkeys for Market.**—Although turkeys are apt to be a little shy and are not naturally quite as tame as other fowls, if well cared for and gently treated they will become quite tame and may be caught without difficulty. When provided with a roost, they can be taken from this very readily. They will be liable to grow shy after some of the flock have been slaughtered. When this is the case, a slip-noose at the end of a strong string spread upon the ground with corn scattered within it will prove quite serviceable. When the bird steps within the circle of the noose draw it quickly and the turkey is caught by the leg.

The writer previously quoted gives his method of dressing turkeys for market as follows: "The night before slaughter the birds are fed as usual, and the barn floor, if not already tight, is made so by nailing boards over the mangers. As soon as the turkeys come from the roost in the morning, the barn doors are open and the turkeys are driven in upon the floor and the door closed upon them. They are now secure, and can be caught as wanted, without bruising the flesh. In a separate apartment in a stable, or under a shed, make as many nooses of strong cord as you have pickers, and sling each bird by the feet as high as will be convenient for handling. With a sharp-pointed penknife, stick them in the mouth by making a gash across the roof near the top of the neck bone, allowing the point to penetrate the brain.

As soon as the bird is dead, work lively at the feathers with both hands, and pick clean, pin feathers and all; cut off the neck as near the head as possible; cut off the wings and draw the crop and entrails. The bird should be taken out of the slip-noose ready for market. As fast as the birds are dressed, they should be put upon a clean board or table to cool. If the weather is very severe the picking of the pin feathers and the drawing may be done in warmer quarters. Great care should be taken not to break the skin, and not to leave a feather. When the turkeys are thoroughly cooled and ready for packing, place a layer of clean rye straw upon the bottom of the wagon and pack them in rows upon their breasts. Clean the necks as thoroughly as possible, draw the skin over the end and tie firmly. Strict attention should be paid to cleanliness in every part of the process, to keep up your reputation for sending only finished products from your farm to market. It will make a great difference in the long run with your bank account."

When scalding is resorted to for removing the feathers the directions should be the same as for dressing chickens previously given. Always draw the birds before packing, and never permit the poultry to freeze before packing, as it gives a blue, pinched appearance. The packing should be done according to directions given for packing chickens.

**Profits of Turkey Raising.**—When well understood, turkey raising is attended with large profits since the outlay is comparatively small, and they always command a good price

in the market. A successful breeder of these fowls in New England says in this connection: "One great secret in raising turkeys is to take care of them and take care of them all summer; and even then you cannot always raise them, for sometimes they will not lay, or they will not hatch, or something will befall them. Sometimes we raise turkeys without much care, when the season is specially favorable, but generally the measure of care is the measure of success. A boy ten or twelve years old, with a little direction from his father, can easily take care of two or three hundred turkeys, and he cannot earn so much money on the farm in any other way. It is an old maxim, that if a thing is worth doing at all it is worth doing well. Some may think this constant care is too much trouble. If you know a better course, by all means pursue it.

This painstaking has made turkey raising about as sure as any other branch of farm industry. I have usually kept from eight to eleven hen turkeys for breeders, and have raised from ninety-nine to one hundred and thirty-seven in a summer. A few years ago I sold my turkeys for 27 cents a pound; they amounted to $380.40. The next year I sold for 25 and 27 cents a pound; gross amount of sales, $386.18. That year I kept an account of expenses, and calculated the net profit at $213.58. The year following I sold at 25 cents a pound; amount of sales, $311.37. I would rather raise turkeys and sell at 15 cents a pound, than to raise pork and sell at 10 cents a pound. Perhaps in fattening pork you can save the manure better, but the turkey droppings, if gathered from under their roosts and saved every week and kept dry, are worth half as much as guano, and are certainly worth a cent a pound."

A gentleman from Rhode Island informed the writer that when a boy of sixteen years of age his father told him if he would take care of the turkeys during the summer he might have all the proceeds from them in the autumn. Stimulated by this prospect, he made his plans accordingly, utilizing all the eggs for sitting that the small flock of turkeys laid, and purchasing a number in the neighborhood, setting them under both hens and turkeys, and so managing that two or three broods would come off about the same time, when the young chicks would all be given to one mother, in which case the others would soon be laying again. At the time of marketing the turkeys, out of four hundred and eighty-six young poults that started in life, four hundred and eighty-four were sold, which was certainly rare success. In considering the average weight and price of turkeys sold in the market, it will readily be seen that this young man was well repaid for his summer's labor. When well understood, and properly managed, we believe there is nothing that the farmer can raise that for the outlay will bring a larger profit than turkeys.

In fact, every department of poultry raising may be made quite profitable under suitable management, and if the practical instructions given in this work relative to it were fully carried out, success must inevitably follow, as a general result. We are indebted to the Editor of the *Poultry World* of Hartford, Conn., for permission to copy a number of cuts in this department from his excellent journal,—a publication that has done much to awaken an interest in improved breeds of fowls, as well as to instruct in the enterprise of practical and profitable poultry raising in this country.

# DUCKS.

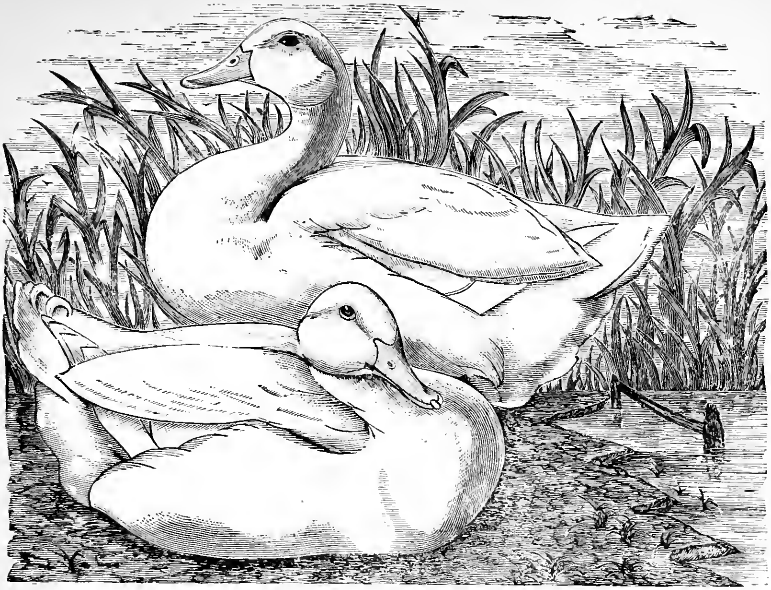
THE various breeds of domesticated ducks are supposed to be descended from the Wild Duck or Mallard (*Anas boschas*) which is distributed so widely over Europe and a large portion of North America. Although frequenting nearly all latitudes, its favorite resort seems to be in the temperate zone. In color the Wild Duck resembles the Rouen, although its form is more slender and upright, and its habits more active than the latter. It is also much smaller in size than the domesticated bird. Ducks are profitable poultry for the farmer to raise, if they can be given their liberty to forage, although they are not as profitable as hens when kept in confinement, because they will consume more food, and lay a less number of eggs. The ducklings are the most active insect hunters known, and in low, marshy grounds, ponds, or streams, they will thrive on grass and plants, feed on myriads of insects and their larvae that may be found in the water, imbedded in the mud or adhering to vegetation, requiring an evening meal of grain or other food to entice them to return regularly to their homes. In fields and gardens they are exceedingly valuable as insect destroyers, while they are easily reared, their feathers are valuable, and their eggs and the young ducks bring a good price in the market.

As to which varieties are most profitable, or best adapted to the farm, breeders of these birds differ in opinion, as some breeds possess certain qualities in a greater or less degree than others. It is, however, considered by many that when flesh and feathers are the principal objects desired some of the white breeds are to be preferred; but if the flesh alone is the prime object, and handsome ornamental birds are wanted, the Black Cayuga and the Rouen should be chosen. Rouen ducklings are thought to be the best insect hunters of all the duck family among the large breeds, while the common gray duck is the best for this purpose among the small breeds. The flesh of the Muscovy Duck is inferior to that of others, while the Aylesbury, Rouen, Pekin, and Cayuga will nearly equal them in size, and are much superior in quality of flesh. The illustrations of the first five in this department represent fine birds from the breeding pens of Mr. J. Y. Bicknell of Buffalo, N.Y., who is one of the best known breeders of this class of poultry in the country.

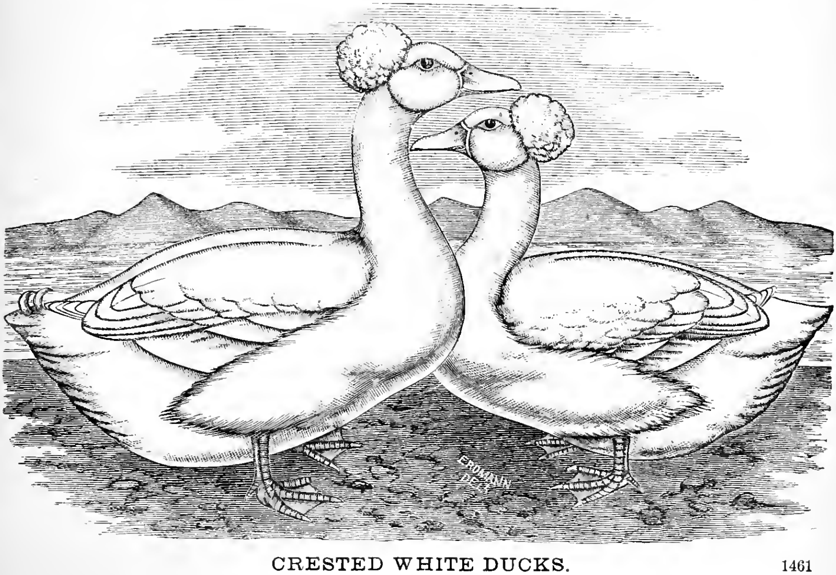
**Aylesbury Ducks.** — This is regarded as one of the best of the English breeds of ducks. They have somewhat degenerated in size in this country, but by careful selection in breeding, using for this purpose only the largest and strongest birds, this tendency may be obviated. They are not quite as large as the Rouen variety, although they nearly equal the latter in this respect, frequently attaining the weight of eighteen pounds per pair. Their plumage is of a pure snow white throughout, with flesh-colored bills and legs of an orange hue. They are oval in shape, with a broad, long back, full, round breast, strong wings, and short, stout legs. The drake shows very handsome curled feathers in the tail. Their eggs vary in color, some being quite white, while others are of a green or cream color.

They commence laying in February, and continue for about five months with two or three brief intervals. They are excellent foragers, but will return to their home regularly at night. They are liable to fall down behind, owing to the stretching of the abdominal muscles. In breeding, such birds should be avoided, whether male or female, as they are apt to be sterile; besides, this is a disfigurement. As soon as this defect is noticed, kill and dress such birds of whatever breed for market.

**Rouen Ducks.** — This breed of ducks most closely resembles the Wild Duck, or Mallard, in plumage, of any of the duck family; domestication, has, however, increased its size and weight, and given it a greater aptitude to fatten. It is the largest domesticated variety known, and is supposed, as its name would indicate, to come originally from the city



AYLESBURY DUCKS.



CRESTED WHITE DUCKS.

of Rouen, Normandy. Mr. W. H. Todd, of Vermillion, Ohio, says of them: "One pair that we exhibited at a show, weighed nineteen and three-fourths pounds; and at home, before the shrinkage of the trip, twenty-one pounds, which was at that time the largest pair in the world." Drakes of nine or ten weeks old have been known to weigh more than twelve pounds per pair. They are the most quiet of ducks, and seldom wander, easy to raise, and will do well with only an abundance of drinking water, although all water fowls attain their best condition when permitted to have access to a small pond or stream of water. The plumage is very beautiful, being changeable in color, with the elegant and decided markings of the Mallard.

The head is long, and in the drake of a lustrous green color; the bill is long and broad, of a greenish-yellow hue, and wider at the end than the base. The neck is long, slender, and colored the same as the head, with a distinct white ring on the lower part that does not quite meet in the back. The upper part of the back is ashy gray blended with green, shading to a deep lustrous green on the lower part and rump; the breast is broad and deep, the front of a rich purplish-brown, or claret-color, which extends down the legs; body broad, long, and deep, the under part of a handsome gray ending in solid black under the tail, which is of a dark-brown color; tail coverts black, with metallic reflections. The wings are grayish-brown in color, blended with green, with a broad band of a purplish tinge, which has beautiful reflections of green and blue in the sunlight. This band is edged distinctly with white. The plumage of the thighs is gray; legs and feet orange, with a slightly bluish tinge.

The head of the duck is a deep brown, with two light-brown stripes on each side, running from the beak behind the eyes. The plumage of the neck is light-brown, penciled with a dark-brown, and entirely free from the white ring that characterizes the drake; the back is light-brown, marked with green; the breast a dark-brown penciled with a lighter brown, the body a grayish-brown, with each feather distinctly penciled with a very dark-brown; wings the same as the drake. They do not come to maturity quite as early as the Aylesburys, but are prolific layers of rather thick-shelled, bluish-green eggs; they are also excellent foragers The flesh is very delicate; the young ducks grow very rapidly, and are easily fattened for market. Like many of the duck varieties, they are apt to have the disability of falling down behind, or what might be called an abdominal protuberance.

**Pekin Ducks.**—This breed of ducks was imported into this country from China in 1873, and are quite an acquisition to our water fowls, being hardy, easily reared, an excellent table fowl, and good layers, while their yield of feathers is nearly as great as that of an ordinary goose. They are white or creamy-white in plumage, with a medium-sized deep yellow bill, and legs of a reddish-orange color. They are large in size, although not equal to the Rouens and Aylesburys in this respect, but owing to their heavy growth of loose and fluffy feathers, they look much larger than their weight would indicate. While swimming, no duck shows so much body above the water-line as Pekins, since their feathers stand out so loosely from the body, while those of other ducks lie down compact and close; for this reason their weight is apt to be overestimated. Their eggs hatch well, the ducklings raise easily and mature rapidly, and are said to be larger at six weeks old than any other breed, which makes them valuable for market at this age. They are excellent foragers, and can be easily raised where there is only sufficient water for them to drink.

Mr. Todd says: "They need no more water to swim in than chickens; cannot fly or climb fences more than a mud turtle, and are so easily restrained that they can be kept within low fences, and almost anywhere." Mr. W. Clift, of Connecticut, who has raised them for several years, says of them: "This variety of water fowl is unquestionably the result of thorough breeding for a long course of years for economical ends. Where the population is so dense as in China, they are compelled to economize in the use of animal food, and much

more attention is paid to the breeding of poultry and fish than in this country. Many live upon rafts or in boats, and keep large flocks of ducks as a means of subsistence.

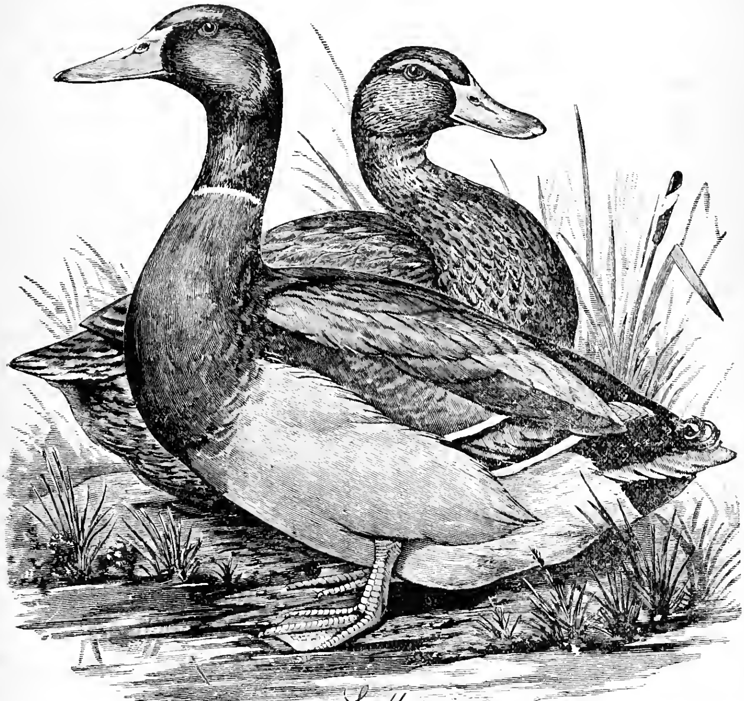
The Pekins, without doubt, come from the Mallard duck, and are the largest of all its varieties. They cross readily with the Rouen and Aylesbury, making larger birds than these, but not equal to the Pekins. Some of the Rouen grades come out clear white, but are readily distinguished from the pure Pekins by the shape of their bills and smaller size. Some of the grades are nearly solid black, and remarkable for their soft, glossy plumage. Others come out looking very much like finely bred Rouens, only with a slight derangement of the plumage. The cross with the Aylesbury seems more natural. The grades are readily distinguished by their lighter bills, smaller size, and different build behind. After experimenting with the crosses for many years, we do not find any improvement upon the Pekins in size, or beauty of form or plumage. We claim for the Pekins a comely form of pure white, which makes them a beautiful object upon the lawn, or for small bodies of water in ornamental grounds. They are exceedingly domestic, easily controlled, and will come at call, when far off upon the water, which makes them desirable pets for children.

They are a very hardy breed, and, judging from the experience of several years, are much more easily reared than Rouens or Aylesburys. They seem larger and stronger when they leave the shell; after a week with the hen may safely be put in flocks of about fifteen, and with a barrel or box for shelter will take care of themselves. They are as easily raised as chickens, and should always be hatched under a hen, as the ducks will pay much better to be kept laying than to be used as mothers. The young ducks require no more room or water than chickens, and do not need water to swim in until they are old enough to forage for themselves. Their instinct leads them to seek their living in the water, and they will wander away from the yard along brooks and ditches unless restrained, but they are easily kept within bounds, being too heavy when grown to fly well, and having been bred for many generations for flesh and eggs, their wings are very short. They mature very early, and in the vicinity of our summer resorts can be marketed in July and August at very high prices; are very prolific, laying, under favorable circumstances, two hundred eggs in a season. After breeding and observing the Pekins from their first importation, we think that they are entitled to the front rank among our useful aquatic birds."

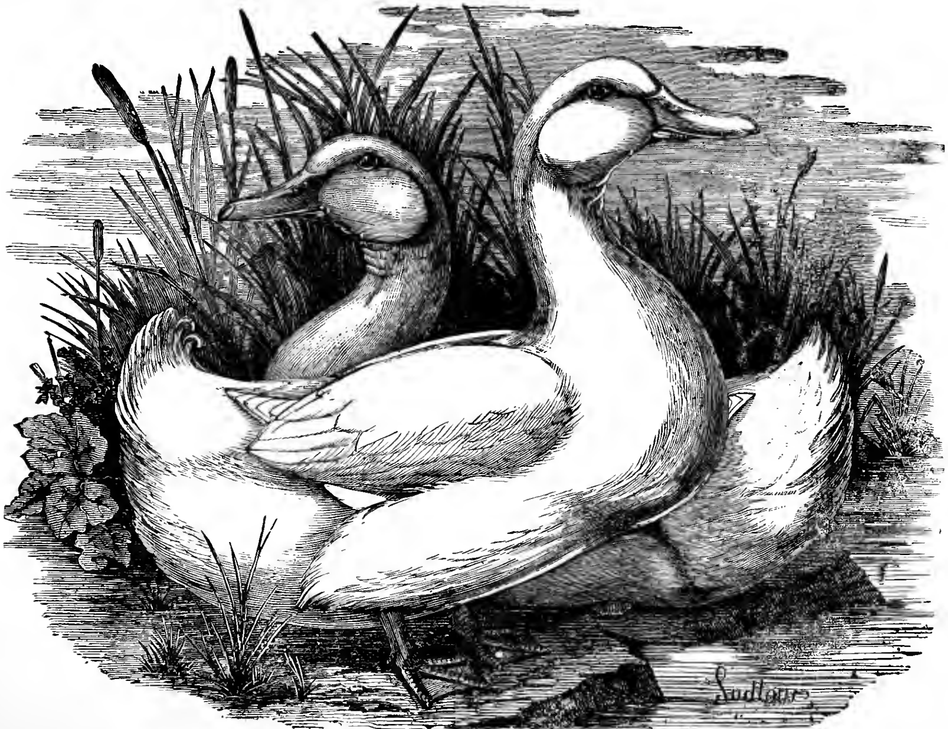
The Pekins commence laying in February, and continue to lay for about five months with two or three brief intermissions. It is better that the ducklings should not have access to water, except to drink, until they have a good growth of feathers.

**Cayuga Ducks.** — The Cayuga Duck is an American breed supposed to have originated near Cayuga Lake, New York, from which they take their name, and where they abound in great numbers. It has long been domesticated in the United States and Canada, and for several years in England. They are decidedly a water duck, and rarely rise from the water, while they are so clumsy on land that they seldom wander far. Their weight at maturity is from twelve to sixteen pounds per pair.

The head is small and slender; bill broad, short, and dark or black in color; neck of medium length; back long and broad; breast full and prominent; body long, round, and plump. Their plumage is metallic black throughout, with beautiful green reflections on the head, neck, and wings; legs dark-slate or black. Their habits are quiet, while they are extremely hardy, early in maturity, prolific layers, and their flesh has a rich, game flavor, although a little dark; and when dressed for market, their skin is quite yellow. In breeding, the darkest males should be selected, since they incline to breed occasional white feathers in plumage. For rearing entirely on land, they are not as good as the Rouen and some other varieties; but in the vicinity of lakes, ponds, and streams, it is one of the best for all practical purposes.



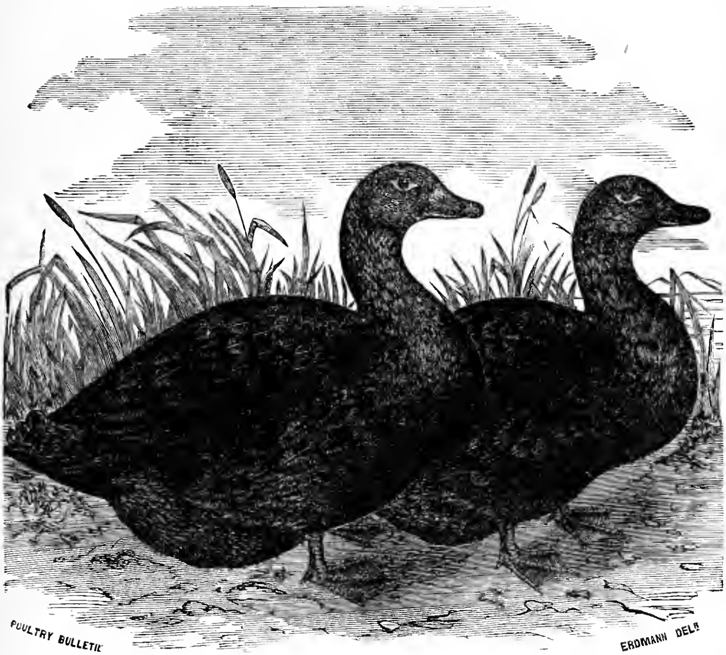

ROUEN DUCKS.



PEKIN DUCKS. 1467

**Crested White Ducks.**—These are of medium size, pure white in plumage, with large snow-ball like crests on their heads, making them quite ornamental, as seen by the illustration of this breed. Their bills are of medium size and yellow in color; legs light orange. They are hardy, easily raised, good layers, and although comparatively rare, are a profitable breed. There are other crested varieties, such as the Black Poland, the Crested Amoor, and a rare species, said to be of American origin, and described by Latham as ashy gray in color of plumage on the body, while that of the neck is of a straw yellow, mixed with spots of a reddish brown.

**The Crested Amoor** duck is found in the northern province of Chinese Tartary, where the Amoor River enters Songoria, and is quite unlike any of our wild or domesticated

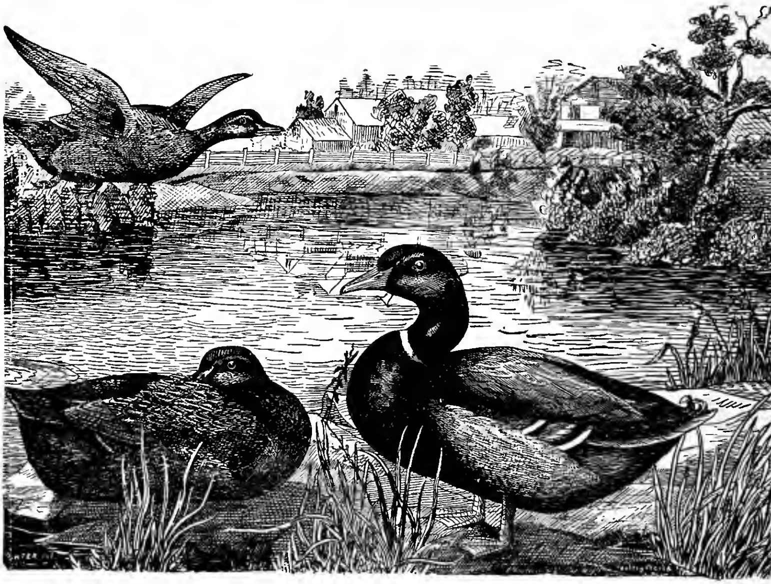



CAYUGA DUCKS.

breeds. It is described by a recent writer as follows: "It is much larger than the Rouen, the feathers on the neck and back of the drake are fine and plume-like, the crest is a pointed tuft of stiff feathers, somewhat crispy and inclined to curl toward the head, the bill is black and extremely long, the plumage is of a dark blue black prismatic, with fine gold dust colored spots on the neck and throat, the wing speculum dark blue edged with white, the tail a dark blue, and the under feathering ashy gray.

These birds are represented to be very prolific. It is said, with proper care, that they will lay eight months in the year. The drakes often attain ten to twelve pounds when well fattened. Their flesh, though dark in color, is sweet, tender, and juicy, and for delicacy and richness of flavor there is no aquatic fowl to surpass them."

**Call Ducks.**—There are two varieties of the Call Duck,—the Gray and the White—that bear the same relation to the large breeds that the Bantams do to the other barn-yard fowls, they being much smaller in size than the average domestic duck, and very active; and for this reason are sometimes called "Bantam Ducks." They are bred as small as possible by all who strive to win prizes with them at the shows. The Gray variety are very similar in plumage to the Rouen breed, so much so that they look like miniature Rouen ducks, while the White are pure white. They are exceedingly ornamental upon private ponds or lakes, and make very pretty pets. They are also very active little creatures, especially during the breeding season, and are gaining in popularity among cultivators of this class of birds. They have a loud and oft-repeated call; hence their name.

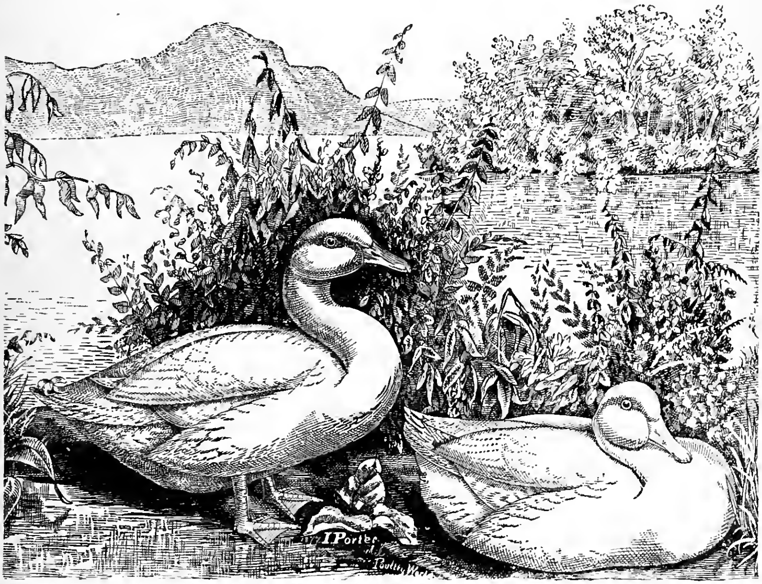


GRAY CALL DUCKS.

They are much used as decoys in wild duck shooting, and for this purpose are made up of a cross between the common small duck and the wild Mallard, the result being a compound of the tameness of the domestic variety, with the power of flight of the wild bird. The decoy bird is trained to fly from the hunter's feet to meet an approaching flock of wild ducks, and at its master's call return to him, leading the flock within reach of its master's shot. These little creatures possess great intelligence and can be easily trained for this purpose.

**Black East India Ducks.**—This variety has been known under various names, such as East India, Labrador, Buenos Ayrean, and Brazilian ducks, etc. They are closely related to the Mallards, and small in size, with plumage of lustrous greenish-black throughout. They are very beautiful birds and exceedingly hardy, but cannot be regarded as profitable for practical purposes, as the larger breeds.

**Muscovy Ducks**—Sometimes known as the Musk duck. This breed seems to be a distinct species, as the progeny of a cross between this and the common varieties is generally unfertile. The name musk duck is derived from the fact that the odor of musk pervades the skin, which, however, is not present in the flesh when cooked. Muscovy is supposed to be a corruption of this term. While the Mallard duck is found wild in the northern regions of America, Europe, and Asia, the wild Muscovy is found only in the warmer regions of South America, while it is never known to migrate. The drakes are larger than those of any other variety, frequently reaching eleven to twelve pounds, while the ducks are rather small in size, not averaging much over six pounds. There are two varieties, the white and colored.



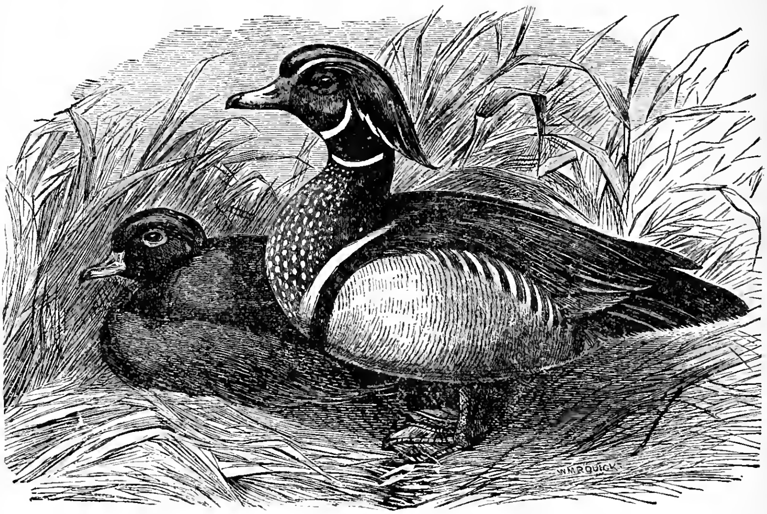

WHITE CALL DUCKS.

The former are pure white throughout in plumage; the latter is a very dark and rich blue-black, sometimes broken with white, of which there is a bar on each wing, and more or less about the head and neck. The darker plumage is exceedingly lustrous; the feathers on the back of the drake being quite fine and plume-like in appearance. They are very peculiar in their appearance, the head and face being carunculated or covered with bright red protuberances, that is, the cheeks are naked, with a scarlet fleshy space around the eyes, and the base of the bill is also carunculated. Mr. Wright says of the drake of this species: "The breed is very large, and the carunculated appearances are in lines far more conspicuous, and give to him in conjunction with a peculiar leer we have never seen in any other creature with feathers on, an aspect almost diabolical."

They never quack, and are favorites with those who admire what is odd in nature. Their flesh is good, and they may be said to fairly equal any other breed in egg-production. They care little for water, are good foragers, and are said to be very useful in devouring

large quantities of Colorado beetle or potato bugs. The period of incubation is five weeks. This bird has been domesticated throughout England and Germany for many years, as well as other portions of Europe, it being also quite common in this country. In a wild state the nests are sometimes built in the branches and sometimes the hollow of trees near the water. About the season of pairing, the drakes are said to fight desperately, and this quarrelsome disposition seems to be inherited by the domestic bird to a considerable extent.

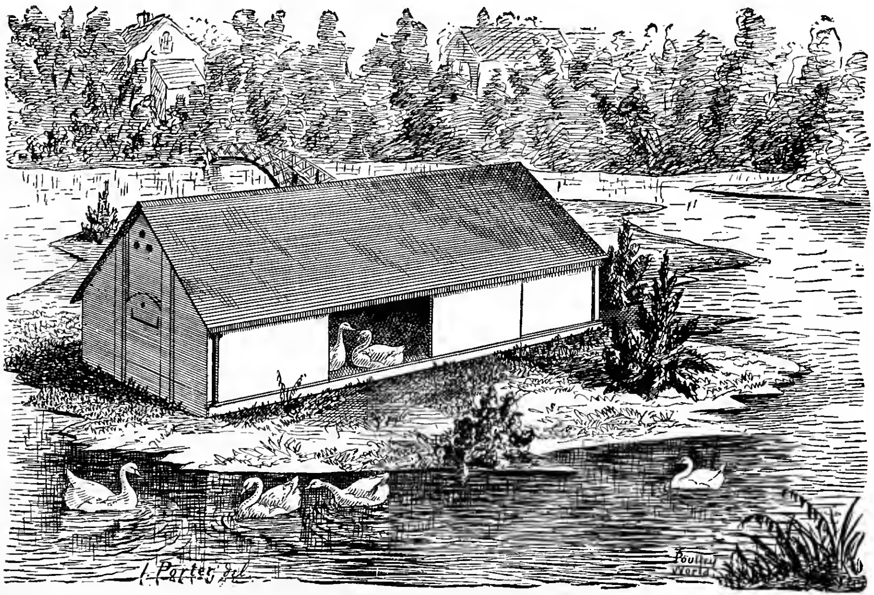
**Mandarin Ducks.**—These are a Chinese variety, sometimes called the Chinese Teal They are quite rare in this country, although more commonly seen in England. They are small in size, but have an exceedingly gorgeous plumage. Mr. Wright describes them as follows: "The shape is light and neat looking, but the plumage of the drake almost defies description, nothing in the poultry world being so bright and gorgeous. The head has a long crest pointing backward, and which can be raised or lowered at will; the color of this crest being green and purple on the top, shading into chestnut and green in the long feathers which




CAROLINA OR WOOD DUCKS.

extend backwards. A broad stripe of rich cream-color extends from the front of the sides of the head across the eye to the back of the neck.

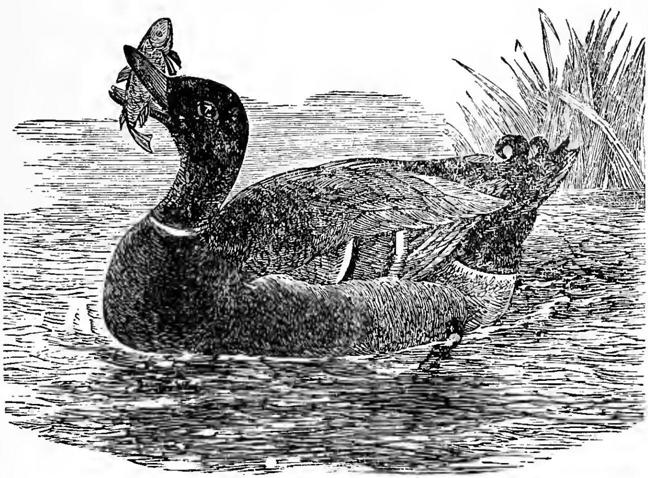
The neck is furnished with a collar or ruff of rich brownish-red feathers, somewhat resembling hackles, and the front of the neck and sides of the breast are a rich claret or purple. Across the shoulders are two beautiful stripes of clear white, each shaded with black, behind which the sides of the bird are of a greenish or ashy yellow, gray, beautifully and most delicately penciled in very fine lines with dark gray or black. The wings are furnished each with a peculiar shield or fan, standing nearly erect, and which are of a bright chestnut color, beautifully edged with green or blue. The feathers of the back are a brilliant light brown, and the under parts white or nearly so. The quills or secondaries are brownish gray, edged on the lower web with white. The bill is crimson, the legs a lightish pink, and the eyes a bright black. The garb of the duck is much plainer, being a mottling all over of greenish brown, with grayish under parts. About May the drake loses his conspicuous




HOUSE FOR WATER FOWL.

feathers, and even his wing fans and crest, and becomes very much like the female; in August he again begins to resume his fine clothing, and by September is again in full plumage."

**Carolina Ducks,** also known as "Wood Ducks," or Summer Ducks," are natives of South America. They are beautiful specimens of water fowl, having a very gorgeous plumage, and a graceful plume of feathers falling back from the head. The drake has a red bill margined nearly to the tip with black, with a spot of black between the nostrils and a kind of hooked point at the end; the head and pendant crest are a rich, glossy bronze-green shading off into violet, and marked with a line of pure white running from the bone of the bill over the eye and another band of white from behind the eye. The upper portion of the neck is of a violet hue, banded with white in front, curving in the form of a crescent behind the eyes; breast dark brown tinged with violet, marked with small white spots; the back a bronze tinged with green; wings blue and green with some markings of white; tail black tinged with green; tail coverts deep black tinged with yellow; legs yellowish red. The head



THE MALLARD DRAKE.

of the duck has a small crest, and although similar in color of plumage to the drake in some respects, it is more subdued. About June the plumage of the drake changes to nearly the same color of the duck, but in September he is in his gorgeous plumage again. These birds, like all wild fowl, increase in size as they are domesticated. Their beauty of plumage renders them great favorites, while they will become very tame when gently treated, and seem to like to be handled and petted.

**Mallard Ducks.**—Although these fowls are considerably smaller than the Rouen, they resemble the latter so closely in color of plumage and other characteristics, that a separate description is unnecessary in this connection.

**General Management of Ducks.**—There is much pleasure, as well as profit, in raising ducks when properly managed. They should be given sufficient range to forage and hunt for a part of their living, and prove excellent help in destroying insects. A brood of young

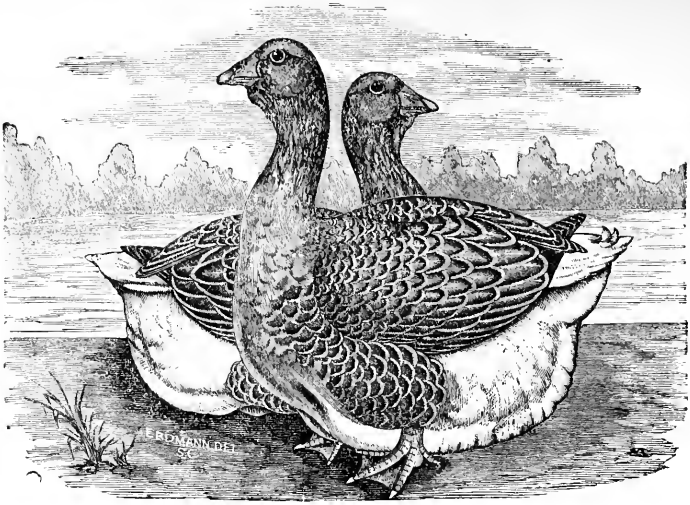
ducks in a garden would well pay their raising merely as insect destroyers, provided no other profit could be secured from them. When kept in confinement they are not as profitable as hens, because they will consume more food, and lay a less number of eggs. Although water fowls and ducks seem more happy and contented when having access to their proper element, a pond, stream, or other body of water of some kind, still they may be raised upon farms where there are no such water privileges, and seem to thrive well. Ducklings mature early, grow rapidly, and at six months old they are ready for market and bring a fair price. Unless there is a suitable place for hatching and rearing, it is better to set ducks' eggs under hens, Cochins or Brahmas being preferred.

The breeding ducks should be kept in their yards in the morning until about ten o'clock, by which time they will have laid their eggs, after which they can have their liberty for the day. It is a good plan to keep them laying through the breeding season, and set all the eggs laid by the ducks under hens. It is surprising what a large flock can be reared in this way from a trio of ducks. April, or the early part of May, is a good time for setting ducks' eggs. The young ducklings will then make their appearance about the time the grass and insects will appear. When ducks are set, they should have from twelve to fifteen eggs, and have a separate division of the duck house kept for this purpose. The door of her house should always be left open during the day, and she should have sufficient water near by to bathe in whenever she wishes. The average time of incubation is twenty-eight days.

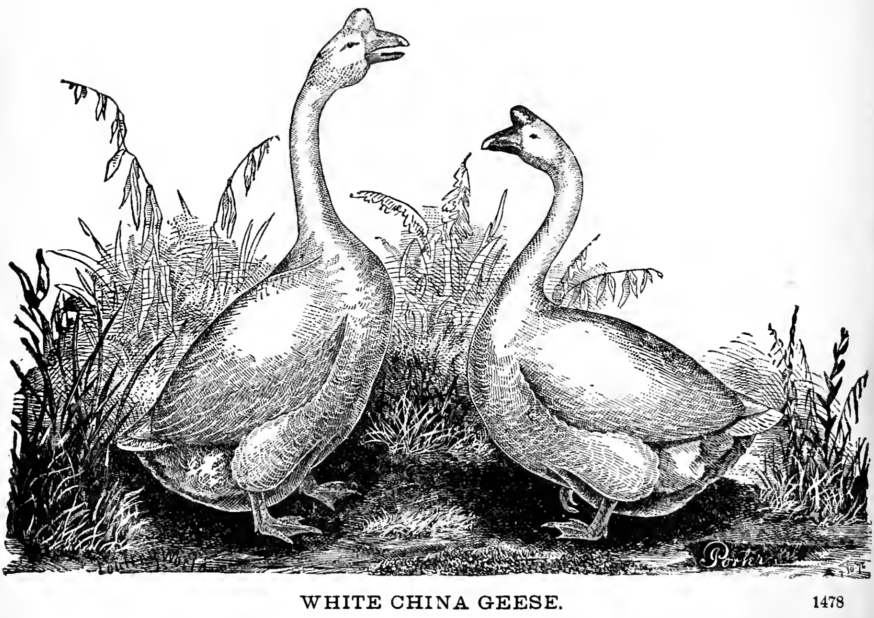
When hatched, the ducklings should not be disturbed for twenty-four hours, at the expiration of which time they will be ready for their first meal, which should consist of hard boiled eggs mixed with oatmeal, or stale bread crumbs soaked in milk; afterward, when three or four days old, give them oatmeal mixed with milk; corn meal scalded and fed warm; boiled potatoes mashed and also fed warm. They will feed upon the tender grass and insects, and will soon consume all the waste of the kitchen, and if a little pains be taken to prepare the food in a proper manner, there need be but little outlay for their keeping.

It is a good plan to let them have a run in the garden each day. If very young ducks are allowed access to a river or stream, they are apt to fall an easy prey to turtles, snakes, etc. Artificial ponds may be constructed for ducks, but they are objectionable unless they can be supplied with fresh, pure water, as otherwise they would be liable to become stagnant. The ducklings of the larger breeds may be made to weigh nine or ten pounds per pair at ninety days from the shell. Ducks should be fed every night when they return from their foraging expeditions, which insures their regular return. Feed them about the same as chickens, often, and all they want, if large birds are desired. When two months old, coarser feed may be given. During the laying season, wheat, oats, milk, ground bone, a variety of grain, mush or scalded meal, meat, egg shells, oyster shells, etc., should be given. Ducks will lay better when they have access to ponds or streams, as they there find their natural food. All ducks are heaviest and fattest in December. Later, as the breeding time approaches, they become lighter; in this condition they lay better, and their eggs will also hatch better.

**Duck Houses.**—In raising ducks a comfortable house should be provided for them, having a good sized yard attached, to which, if practicable, access should be had to a small body of water. An expensive house need not be made; any little low house will do for ducks, which should be kept clean and well ventilated, and supplied with fine hay as a bedding. A successful breeder of ducks says: "We have known a flock of ten breeding ducks to have been well kept in a house eight feet square and three or four feet high, with a yard ten feet long. They were, of course, allowed their liberty during the day, after they had laid their morning's supply of eggs." This would, of course, be very limited quarters for a flock of ducks of this size, but ducks can be reared with much less house room than is required for hens. Facilities for keeping a good supply of drinking water constantly on hand should be made in a duck house; also feeding troughs the same as for hens.



**TOULOUSE GEESE.**
Owned by J. Y. Bicknell, Buffalo, N. Y.



**WHITE CHINA GEESE.**

# GEESE.

GEESE have been domesticated for ages, having been held in great favor with the ancient Eyptians, as is evidenced by their being frequently seen in their hieroglyphics. As an article of food they are more highly esteemed in the Old World than on this continent, where the turkey seems to take the first place among poultry. The flesh of the goose is, however, highly valued in this country, and has a peculiarly rich flavor, although more oily than the turkey or barn-fowl. There are fewer varieties of the domestic goose than most of the other breeds of domestic fowls; the principal being the Toulouse, Embden, Chinese, African, Egyptian, while we have also the Sebastopol, or frizzled goose, and several wild varieties which are readily tamed, among the best of which are the American or Canadian goose and the Grayleg of Europe. There is also the variety known as the Bean Goose, which is easily domesticated, the Gambrian, Barnacle, etc., of the wild species.

Geese will live to a great age, — an age entirely ont of proportion to the brief time required for them to reach maturity. Birds of forty years of age are reported, while a recent writer mentions a venerable "grandmother goose" of sixty years of age, still hale and active. A work on poultry mentions a goose that at the time of writing was forty years old, still laying yearly her clutch of eggs, and bringing forth a fine brood of goslings, while geese of twenty years of age are by no means rare. Great numbers of geese are raised in Holland and some portions of England and France. In the migration of wild geese, they almost always retain the V-shaped ranks unbroken, being guided by their leader, who keeps up a peculiar call as his phalanx follow him through the air. There are few, if any, birds that mature so fast, which makes them profitable to raise, while their principal food being grass, little expense is required in raising them.

**Toulouse Geese.** — These are the two largest geese known; they are very compact in body, dignified in carriage, quiet and gentle in disposition. When three years old and well fattened, they will frequently weigh forty-five to fifty pounds per pair, sometimes reaching as high as sixty pounds per pair. They will lay from thirty to forty eggs in a season, and seldom sit. Their feathers are valuable, of which they will yield about half a pound at one "picking." The goslings are more hardy than the common variety, and grow very rapidly, frequently weighing, when four or five weeks old, from six to eight pounds each, and at three months, from fifteen to eighteen pounds. They require no food but pasturage, except in winter. In color the geese and ganders are alike, but can be distinguished by the form and voice, the gander being taller and more upright than the goose, while they have larger necks, a higher-keyed voice, and gobble in more rapid tones than the goose, which has a low, deep voice. The color of the plumage of the head and neck is dark-gray, that of the breast and body light-gray shading to a white under the body. The wings are dark-gray or brown; tail gray and white, the ends of the feathers being tipped with white; color of bill and feet a reddish-orange. The quality of flesh is good.

**Embden Geese.** — Among the varieties of domesticated geese, the Embden is regarded by many as the most valuable. The body is large, broad, and deep; the neck rather long and carried quite upright; head rather large, with large, bright-blue eyes; bill of medium size and length and flesh-colored. The color of the plumage is pure white throughout; legs orange-colored. In size they are nearly that of the Toulouse. They are hardy, early layers, and frequently raise two broods in a single season. The eggs are large, with a rough, thick shell, and white in color. Like the Toulouse, they will not commence laying until a year old.

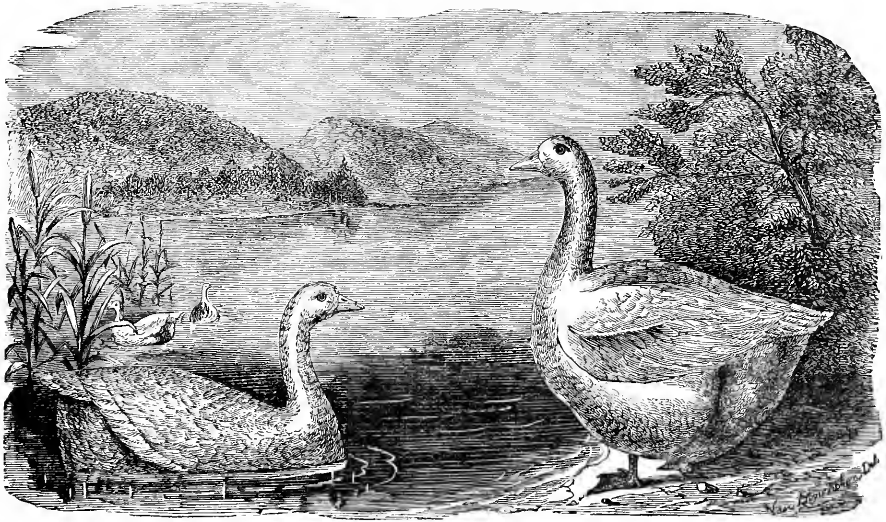
**Chinese Geese.** — There are two varieties of Chinese geese, the white and the brown. The former are in plumage pure white throughout, with orange-colored legs and bill, and a large orange knob at the base of the bill. They are large in size, with long slender necks gracefully curved, which gives them a swan-like appearance. A great peculiarity of this breed is the great difference in size between the males and females, the former being nearly a third larger than the latter. They are an ornamental fowl, hardy, easily raised, and an excellent table fowl. They are prolific in eggs, which are of a small size compared with the size of the fowl, and sometimes rear three broods in a single season. The brown variety have rather a large, long head, dark-brown or black bill, with a black knob at its base; color of plumage grayish-brown, darker on the back, wings, head, and back of the neck than other portions of the body; legs dark, or dusky-orange in color.

**African Geese.** — Birds of this breed are quite large, and have one peculiar characteristic, which consists of a large black knob at the base of the upper mandible, and a heavy dewlap under the throat; for which reason they are known in some sections as the "Brown Knobbed Goose." Early importations are said to have attained the weight of fifty-six pounds per pair. They are somewhat rare in this country, but are really a valuable variety. The color of the plumage is mainly dark-gray, the front part of the neck and under portions of the body being light-gray. Bill black; legs dark-orange. They are nocturnal in habit, excellent layers, and the flesh of the young birds is of fine texture and flavor.

**The Canada, or Wild Goose.** — This is a native of the United States and Canada It breeds in the far North, spends the spring and autumn in the temperate regions, and goes to the South, even to the Gulf of Mexico, in the winter, going North again towards the approach of spring. Wilson was of the opinion that the range of the Canada goose "extended to the utmost polar point, and the silent desolation of unknown countries, shut out from the prying eye of man by everlasting and insuperable barriers of ice." Its curious habit of flight and peculiar cry are familiar to every one. This bird is large in size, being about the weight of the Gray Leg goose. It has a long, slender neck, which gives it something of the appearance of a swan. The head, bill, and a large portion of the neck are black, with a white band about the throat. The feathers on the back and upper part of the body are a brownish-gray with light edges, which shades through light-gray to white on the under part.

The wing quills and tail are nearly black, the legs are dusky color, nearly black. It is easily domesticated, and is said to be the most sagacious of any of the goose tribe. When hatched from eggs of the wild bird, they often become thoroughly domesticated in the first generation. It breeds freely with the other varieties of geese, and when domesticated retains much of the game flavor of the wild fowl.

**Egyptian Geese.** — This variety of fowl is noted for its beautiful plumage and stately carriage. It is sometimes called the Nile Goose, and extends from Alexandria to the Cape of Good Hope, and is frequently seen in England in a wild state. It is quite rare in this country, and is said to be a poor breeder. The head is of medium size and rather long, black and gray in color, with a chestnut patch around the eyes, which are of an orange color; the bill is of medium size and length, purple or bluish-red in color; neck rather small and of medium length. The back is narrow, curving from the base of the neck to the tail; body long and slender. The color of the plumage of the neck is gray and black; that of the breast partially gray, being of a chestnut color at the center; the upper portion of the body is gray and black, the under portion a pale buff or yellow, evenly penciled with black lines. The wings are white at the shoulders, with a narrow black stripe of metallic lustre, and the primaries and secondaries a glossy black. On the wing joints are strong, white, horny spurs about five-eighths of an inch long, instead of the hard knobs which most of the varieties of

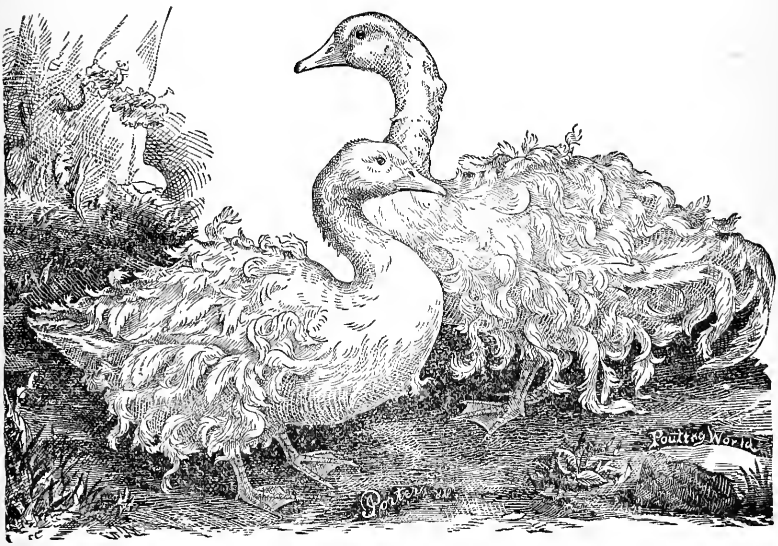


EMBDEN GEESE.

1481

geese have. The tail feathers are black, the thighs pale buff in plumage, and the legs a reddish yellow.

**The Sebastopol Goose.** — This is a very peculiar variety derived from the region from which it takes its name, and sometimes called the Danubian Goose, it being quite common in the region of the Danube. In form it resembles the common goose, the peculiarity being in the plumage which seems to grow the wrong way, like that of the Frizzled Fowl. The plumage is pure white, and from the tail and saddle they have long trailing feathers which are beautifully curved, while they are so thin in the quill that the least breeze blows them about, and are said "to look as though they were hatched in a gale of wind." The average weight of these birds is about ten pounds each. They breed freely with common geese, and the progeny generally show the peculiar plumage in a modified form.

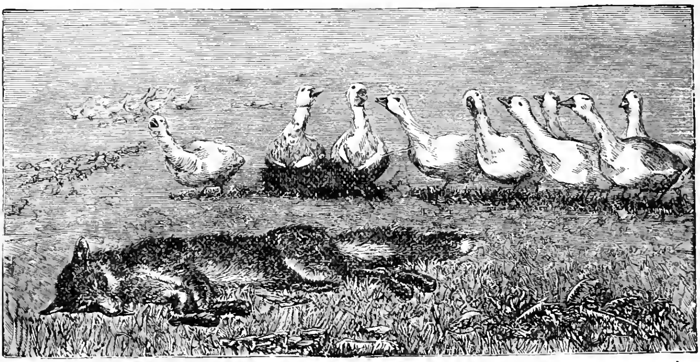



SEBASTOPOL GEESE.

**General Management of Geese.**—The raising of geese is a very simple process, and may be made quite profitable where there are the proper surroundings and facilities. They may be raised with only sufficient water for drink, but it is better for them to have access to water in the form of ponds, streams, marsh, swamp, or sea-shore estuary, if practicable. There is usually one gander to three or four geese, but some breeders prefer them in pairs, as the male guards the nest during the incubating season, while the goose is off feeding. The gander is best for breeding purposes after his second year, and he will remain in full vigor for several seasons. Old geese make better mothers than young ones. When first commencing to lay, geese are apt to be irregular, but when more mature they will lay regularly, and yield a litter of from fifteen to twenty eggs before inclining to sit. The average number of eggs laid by geese in a year is from forty to forty-five, but they occasionally lay from sixty to seventy. This number is, however, not common.

Breeding geese should be kept rather thin in flesh, and have a free grass range. When broody, the goose will remain upon her nest after laying. She should have a deep nest, oval in form, and from thirteen to fifteen eggs to sit upon. She will hatch in from twenty-eight to thirty days, according to the warmth of the season, and should be left unmolested, except that she should have food and water near her nest, for if left to gather her own food, she will be liable to leave the nest too long and allow the eggs to become chilled. The season for hatching is from April to July, although goslings hatched as late as September will winter fairly well. Newly hatched goslings, like ducks and chickens, do not require food for the first twenty-four hours. They should be fed with hard boiled eggs, chopped fine, for a few days, together with stale bread, soaked in milk, scalded meal, boiled potatoes, tender grass and lettuce, etc. They should be kept away from the water for two weeks, and when hatched early in the season should be housed in a dry, warm place, until they are strong enough to run about well.

They should not be allowed access to a body of water until two or three weeks old, the down on their bodies, when first hatched, not being a sufficient protection from the chill that



"ONE WAY OF PLAYING THE OLD GAME OF FOX AND GEESE."

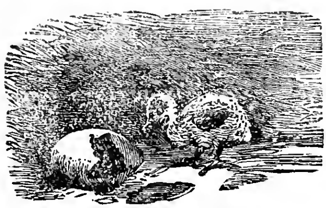
would be thus occasioned. They should be regularly housed at night, and be fed for several days at morning and night with soft food, like scalded meal and bran, or mashed boiled potatoes. Young goslings should be well protected from the rain, and never allowed to wander in the wet grass. Geese are great foragers, besides, where they can obtain an abundance of grass this will form more than half of their food during the summer and early autumn. They require grass as much as cattle, and should have this in abundance.

Most breeds are apt to be rather noisy, and hence it is best to confine them in a fenced field or pasture that contains a marsh or stream of water. They will pick up considerable food from such ground. Old geese are apt to be very pugnacious when they have goslings, and will often destroy young ducks, chickens, or turkeys, with a stroke of their strong bill. They should therefore have quarters removed from other poultry, to obviate such danger. Geese are peculiarly inquisitive birds,—a trait which the above cut well represents. Rats will devour young goslings or other young poultry, if they have the opportunity and are plentiful in the immediate vicinity of the goose-pen. The fox is also an enemy to the goose tribe, as well as the skunk, weasel, and musk rat, and will be attracted from a long distance in the night to quarters where they are kept. The building where geese are sheltered at night, or sit, should therefore be well protected against their intrusion.

CANADA GOOSE.

The house for geese should be similar to that for ducks, and need not be necessarily expensive, but should be warm and dry. Many breeders prefer to sit the eggs of geese under hens. In such cases the goslings may be turned into the field by themselves at four weeks old, but should be looked after and be given shelter at night, or when there is a storm. After this age they may be fed with scalded meal, cracked corn, boiled vegetables, and vegetable or apple parings, but should always have access to an abundance of fresh grass. In winter they should have a variety of food, consisting of boiled vegetables, corn, and other grain, meat scraps, oyster shells, turnips sliced thin, cabbage, etc. When properly cared for, geese will generally have no diseases whatever.

**Fattening Geese.**—Geese are excellent table fowls, if taken when they are in their best condition, which is when they are ten or twelve months old. An *old* goose cannot be called a toothsome diet. They will fatten more readily if allowed good foraging ground, and fed from the time of hatching all through the season. For fattening, the best corn meal and potatoes, boiled together to a thin mush, is as good food as can be given them; they should have this three times a day in quantity all they will eat, and in about two weeks they will be ready for market.



THE OLD WORLD AND THE NEW.

## SWANS.

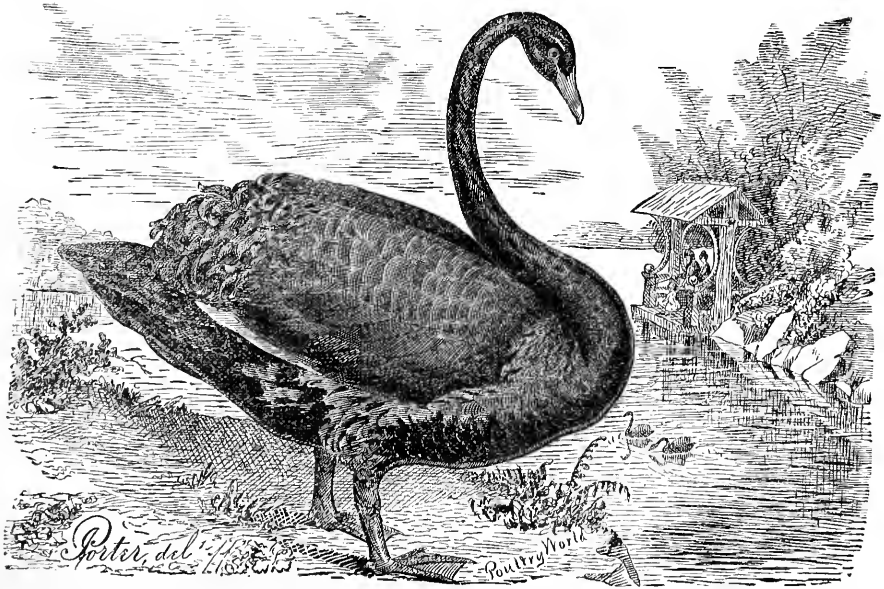
LIKE wild geese and ducks, swans have a wide range, being found in all regions but those lying in the torrid zone. Writers mention at least two species that are common to both Europe and America, besides others more local in their character. Mr. Wright says of these birds: "Every race (we believe without exception) is naturally migratory in its habits, though many individuals will remain, especially in the more temperate regions, in the same localities throughout the year, only taking short flights to and fro. In emigration they assume more or less constantly the V-shaped phalanx, which thus seems common to all aquatic birds. Their powers of flight are considerable when once fairly raised in the air, but the rising appears to be difficult and awkward. They almost always, if not invariably, rise from the water, striking down with both wings and feet, and thus proceeding, half flying and half splashing, for some twenty or thirty yards before they can fairly raise themselves; after which, however, they frequently attain a great height, Franklin stating that he has seen them in the Polar regions several thousand feet above the earth. They always descend, also, into the water, approaching it in a slanting direction, and stretching out their broad, webbed feet to check their speed at the moment they enter the familiar element.

Swans generally pair for life, their whole behavior offering a beautiful example of conjugal fidelity. The two birds show the greatest affection for each other, always swimming in company, and caressing each other with their bills and necks, in the most interesting manner; and should either be attacked, the other will show fight in the most vigorous manner, though of course the male is the most powerful and courageous. Both birds help to prepare the nest, the male chiefly getting the materials, while the female seems to take the chief part in the actual construction. A swan's nest is an enormous affair, being built up of a large mass of coarse water plants as a foundation, which is lined with fine grasses. In this, six to nine eggs are generally laid, which are, of course, very thick in the shell, and generally of a dirty white color, sometimes dirty pale green.

The time of incubation has been differently stated, but we believe Bechstein to be right in fixing it at thirty-five days, though some have said forty-two. The young, when hatched, are very thickly covered with down, and are generally taken to the water by the mother when only a day or two old. There they are watched over by both parents with the greatest care until grown enough to provide for themselves." We know of a pair of swans in a park of one of our large cities, a few years since, that exhibited the greatest affection for each other. After a time the female sickened and died. The male drooped for a time, and was finally found dead one morning, evidently having pined himself to death over the loss of his mate. There are in all about ten species of swans known, most of which are pure white in plumage. The flesh is not good except when the birds are young. They are the most graceful upon the water of all aquatic fowls, and are a rare ornament to either public or private parks.

**The Mute Swan.**—This is a native of Northern Asia and Europe, and is one of the largest and most graceful of all the swan species. The neck is long and slender, the bill red, and the protuberance at the base black; the legs and feet a dark brown or gray. The plumage is pure white throughout.

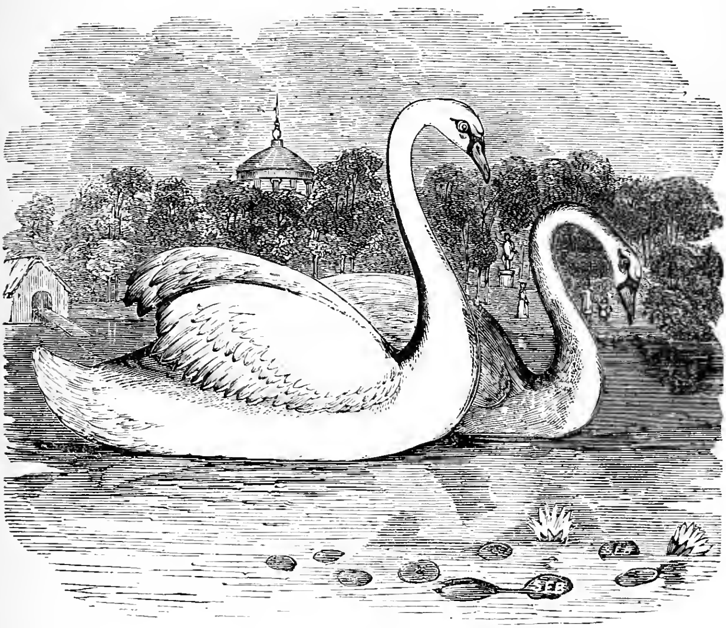
This bird is not mute, as its name would indicate, but has a very soft low voice, somewhat melancholy in tone. The cygnets, or young swans, when first hatched, and for some time after, are gray, and may be frequently seen on the back of one of the parents when they are swimming in the water. There is another large white swan, closely resembling this




BLACK SWAN.

species, and sometimes mistaken for it, known also as the Polish swan, the young of which are pure white when first hatched.

**The Whistling Swan.**—This bird is called by naturalists *Cygnis musicus* (musical swan); it is somewhat smaller than the Mute Swan, and its neck is shorter and thicker. It has a pure white plumage, yellow bill, which lacks the protuberance of the latter mentioned species. Different writers, in describing this species, all mention the peculiar musical qualities of its voice. Faber says: "Their tuneful, melancholy voices sound like trumpets heard at a distance." Olaf writes: "When a company of these birds passes through the air, their song is truly delightful, equal to the notes of a violin;" while Schilling



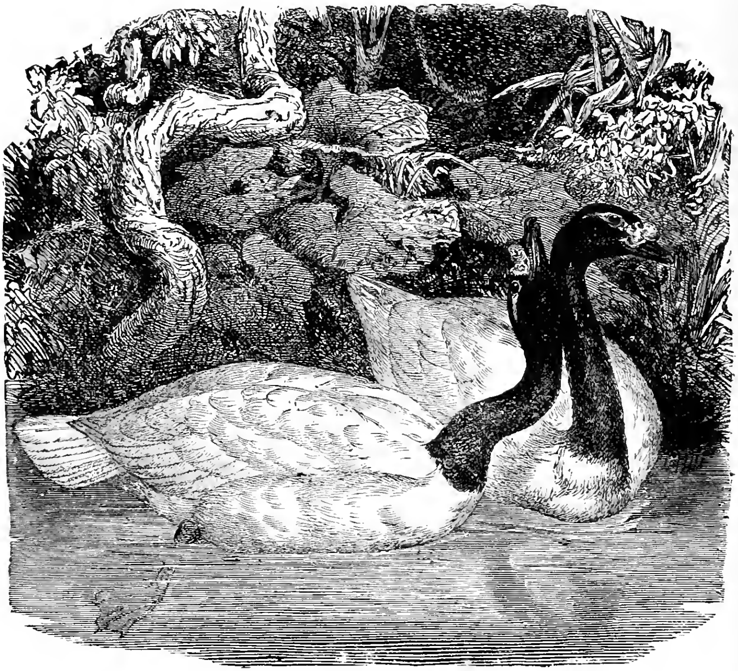
THE MUTE SWAN.

describes the tone as sometimes resembling the sound of a bell, and sometimes that of some wind instrument. He says: "This peculiar concert realized to my mind the truth of what I had heard concerning the song of the swan, which I had before regarded as a poetic fiction."

**The Black Swan** is a native of Australia, and, next to the Mute Swan, is one of the most common varieties. It is smaller than the latter, although resembling it in general outline. The plumage is black, shading on some of the feathers to a dark gray; eyes, scarlet; bill, red tipped with white; legs, black. The young are quite hardy. This species is said to be not as gentle in disposition as the Mute Swan, and inclined to be tyrannical and domineering over smaller water fowls.

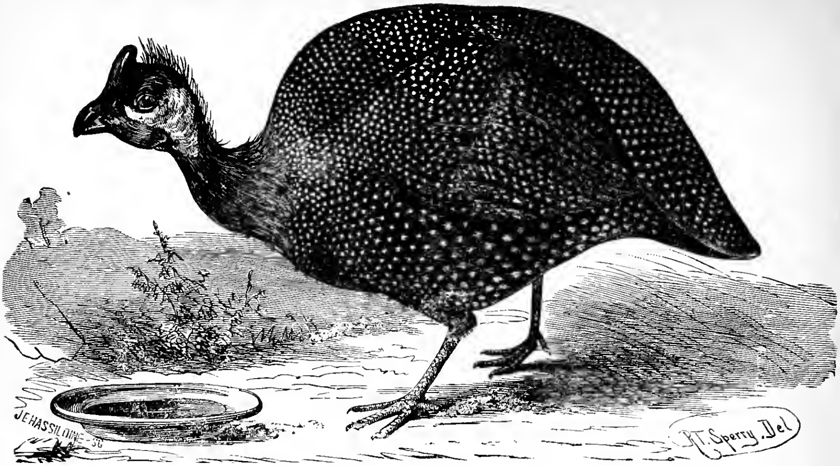
**Black-Necked Swan.** — This species is a native of South America, and is sometimes known as the Chilian Swan. The plumage of these birds is snow white, except the head and neck, which are jet black, all but a narrow streak of white across the eyes. The bill is lead color, with red protuberance; legs, reddish orange. In swimming, this bird carries its neck erect, more like the goose, and not curved like most of the other species of swan.

**Management of Swans.** — These birds should be provided with shelter near the edge of the water, to which they can have easy access. A small house will answer the purpose, suitable provision being made for nests and feeding. They are powerful birds, guarding their nests and young with zealous care, and will not tolerate any interference

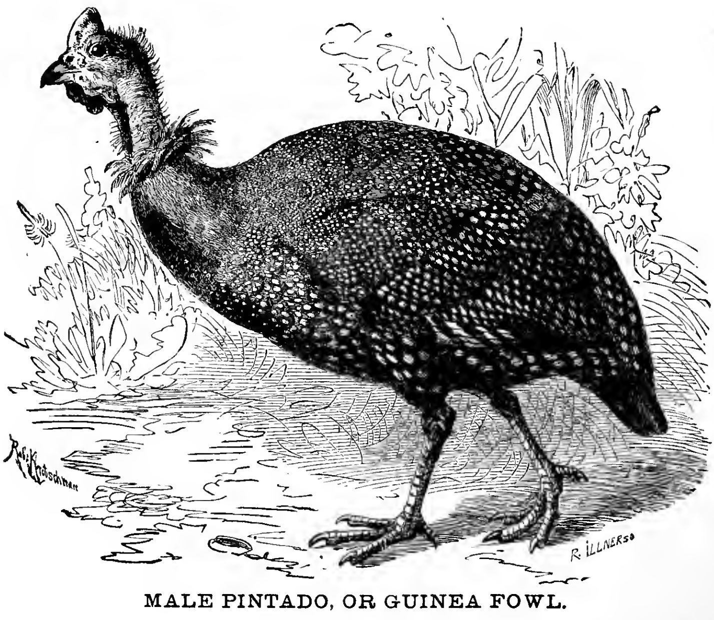


BLACK-NECKED SWAN.

during the season of incubation. But little can be done except to provide food and proper shelter, unless the birds have been previously made quite tame. When petted and frequently handled, they can be made very tame, swimming a long distance to feed from the hand. Their food should consist principally of grain, a variety being as necessary as for other birds. If the young swan are wild when hatched, soaked cracker or bread may be thrown to them upon the water; but if the old birds have been thoroughly domesticated, the young will be apt to be quite tame. Swan's eggs may be hatched under geese or large ducks, in which case they may be brought up quite tame.




GUINEA HEN.




MALE PINTADO, OR GUINEA FOWL.

# GUINEA FOWLS.

THERE are many varieties of the Guinea fowl, all of which are supposed to have originated in Africa. Among the many races of this bird some have a peculiar bony-like helmet on the top of the head, while others have in its place a crest of feathers, which varies more or less in different varieties. The most common varieties are those with a plumage of dull black or dark bluish gray, finely dotted with white, and those of pure white plumage. Guinea fowls are very useful where there are many enemies to poultry, such as hawks, crows, rats, etc., as they are ever on the alert for danger, and give the alarm in a loud, shrill cry. An extensive poultry keeper says of them:

"To any one keeping a large number of hens a pair of Guineas is a good investment. I know from experience that they will and do keep the hawks away. We live right under the mountain (a favorite haunt of the hawks), but as long as our Guineas sun themselves on the barn and exercise their vocal powers in the yards, the hawks prefer to swoop down upon the defenseless poultry yards of neighbors or lie in wait for unlucky rabbits.

Once when our Guineas had a brood of young I saw the hen rise on wing and chase a yellow-eyed monster who had designs on her young family. We have for several years past lost but one chicken by the hawks."

They are prolific layers during the summer season, but their eggs, though small, are rich in flavor, and fully make up in numbers what is lacking in size. The flesh of these fowls is relished by those who are partial to a gamy flavor and dark meat. The principal objection to these birds seems to be in the noise they make, as they keep up a screeching, disagreeable sound; also in the difficulty of rearing the young chicks, which, when first hatched, are very tender. They are apt to be pugnacious and domineering over other fowls when permitted to mix with them, and quite inclined to steal their nests away, by which means many of their eggs are liable to be lost.

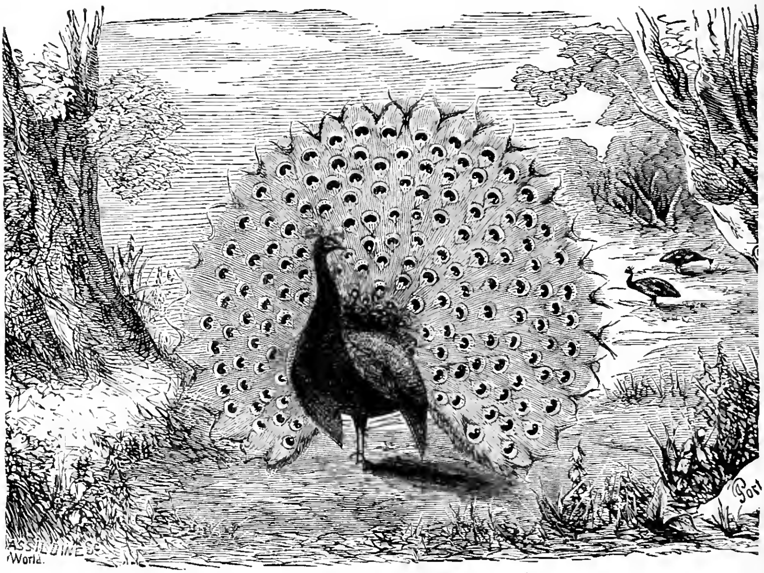
**Management of Guinea Fowls.** — Although long domesticated, Guinea fowls still seem to retain much of their wild nature, the young chicks when hatched being quite wild; but, when kindly treated and often fed, these birds will become sufficiently tame to eat from the hand, and will not wander far from home. They usually commence to lay in June. The eggs have a thick shell, which is about the color of that of the Brahma, but quite speckled. When set under a hen, they require a month's sitting. The chicks, when first hatched, are very tender, and continue to be so until they change their coat of soft down for one of feathers. After this critical period they seem quite hardy, and will, in a great measure, take care of themselves. They are very pretty little creatures, of a dun color, and remind one of young partridges. A breeder of these fowls says:

"The first one I reared was an odd egg put under a hen for an experiment, early in the spring. The hen hatched twelve chickens, and then kept on sitting till the Guinea chick was hatched. (I did not then know how long the chicken would be coming from the shell). After it was hatched I put it with some young chickens two days old, and it grew and flourished, eating the same as the chickens. What seemed to me very strange was that when fifteen more little Guineas hatched, the first one would never stay with them, but made a shrill whistle till I put it with the chickens, when it would seem perfectly happy; and to this day, although ten months old, it prefers to be with its foster brothers and sisters rather than with the Guinea hens. This shows how tame the birds may become."

It also shows how easily they can be trained to run with the hens, and when so reared they will not be as apt to quarrel with them. Young Guinea fowls should be fed and managed generally the same as young turkeys. These fowls, like turkeys, will be inclined to seek high roosts, such as trees and the top of sheds, but should never be permitted to do so. They should be provided with shelter and roosts, the same as barnyard poultry.

# THE PEA FOWL.

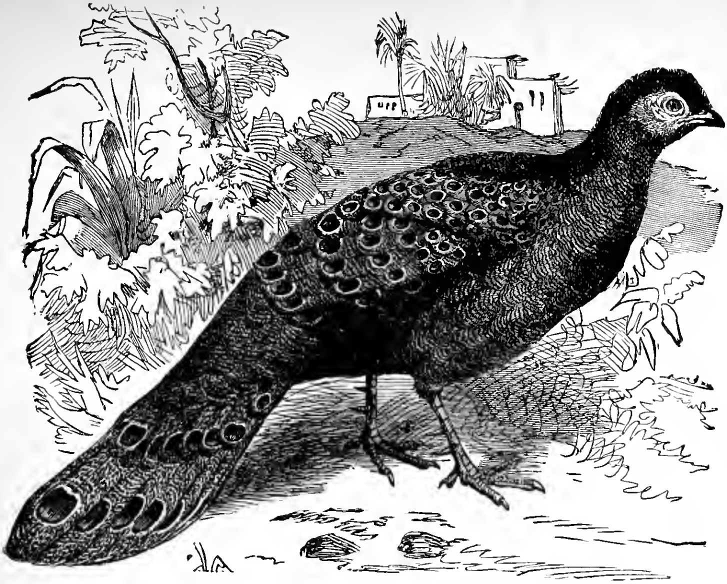
EASTERN ASIA seems to be the original home of this beautiful bird, from which region it has been widely disseminated throughout a large portion of the globe, and so well known that it scarcely requires a description. The plumage of the head, neck, and breast of the male is a beautiful purple, with blue reflections; that of the back green, with copper-colored lacing; the wings a mincing of white, black, blue, bronze, and gold tints. The tail coverts are a glossy green, with bronzy golden reflections, ocellated at the tips. The neck is long and slender, and the head small in proportion to the size of the body; it is surmounted with a small crest of twenty-four feathers, which are webbed only at the tips, and have green and blue reflections. The Pea hen is less gaudy in her attire, the prevailing color being chestnut brown, which is shaded and mottled in different parts of the



PEACOCK.

body. Her crest is much smaller than that of the male. The Japanese peacock is more gorgeous in plumage even than the former variety, the reflections being exceedingly rich, and consisting of a strange blending of glossy green, purple, blue, and coppery or bronzy gold. White peacocks are sometimes seen, but are not as desirable as the colored, since they are greatly inferior in beauty, and are also less hardy.

**Management of the Pea Fowl.**—Mr. Wright gives the following general directions for managing these birds: "Little can be said about their management; they must be left to a great extent to themselves. One cock should not be allowed more than four or five hens, and they should be regularly fed. The hens lay their eggs in the most secluded place they can find,—somewhere deep in a copse or shrubbery in general, though some will take to the long grass in an open field,—and must *on no account* be disturbed. They are so impatient of their privacy being invaded that such an event is nearly always followed by 'soft eggs,' or if sitting at the time, with failure; but if left to themselves they will almost always bring off



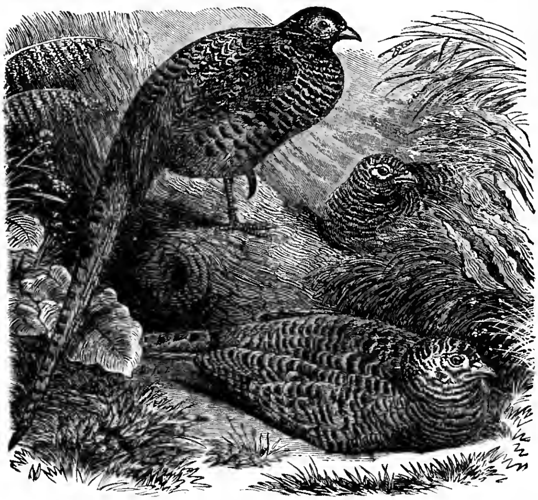
PEACOCK PHEASANT OF ASSAM.

CALIFORNIA QUAIL.

regular and good broods. When hatched the chicks should be treated very much as young turkeys, except giving them more animal food. They are not, however, so delicate as turkeys, and in fine weather they should always be let out, but only on short grass. After a fortnight they need very little care indeed.

The peahen goes with her chicks about six months, or even till next spring, and is a very fond mother. The young appear to need this extended protection, and hence it is almost useless to attempt to hatch the eggs under common hens, which discard their brood at two months, unless artificial mothers are provided to nourish them afterward. Till they moult at eighteen months old, the cocks remain the same color as the hens, and do not get their plumes in full beauty till their third year. Both sexes moult very fast, and appear to suffer much during the process, always seeking the deepest seclusion at such times. It is, however, rapidly over if all goes well, though the new train of feathers seem to remain very short for some little time, when they appear to take a fresh start and rapidly assume their former length."

The scream of the peacock is very tiresome and disagreeable, and the oird is generally very quarrelsome with other poultry, sometimes even eating young chickens. It likes to roost on the ridge of houses and in trees, but is apt to get frost-bitten in cold weather in such exposed places.



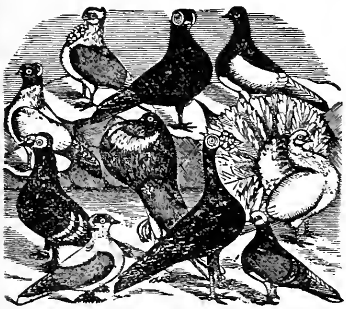
ENGLISH PHEASANTS.

**Pheasants and Quails.**—The pheasant is a gallinaceous bird of the family *Phasianidæ*, and has been domesticated in many portions of both Europe and America for several years. When well fattened, the common pheasant attains the weight of about five pounds; the quality of the meat is excellent, possessing a very delicate flavor. They are quite hardy, and easily reared, requiring about the same care as chickens. A beautiful variety known as the Peacock Pheasant is classed by naturalists between the peacock and the pheasant. The plumage of this bird resembles that of the peacock, each feather on the back and in the tail having a beautiful ocellus, or eye with greenish and blue reflections, like the latter. These birds are quite rare. Quails are beginning to be domesticated to a limited extent, and although sometimes when hatched by a hen they will seek their wild companions after remaining several months with their foster mother, if they have the opportunity, when kept in confinement the enterprise has proved quite a success. The quail feeds upon all kinds of grains and insects, and sometimes grapes, but is content with but a small quantity of the latter, while it destroys vast numbers of the chinch bug and other insects, and the good accomplished by this bird in this respect many times compensates for the small loss in the grape product from the vineyards. The objection, therefore, that is sometimes urged against the Valley Quail in California is not well founded. When domesticated, they should have the same care as chickens

# PIGEONS.

THE numerous varieties of domesticated pigeons, amounting to more than two hundred and fifty, are supposed by naturalists to have descended from the common wild pigeon so well known and widely distributed over both continents. This great diversity from one common ancestory shows what can be accomplished in the art of breeding with a specific object in view. Pigeons make beautiful pets for children or older members of the household, and are an attractive and pleasing adjunct to the surroundings of a country or city home. They require but little care, and well repay for their keeping. Fancy pigeons are divided into two classes, viz.: the "high class" and the "toys." Some of the principal among those recognized as belonging to the former, are the Pouters, Tumblers, Almond, Short-faced Carriers, and Barbs, while the leading toy varieties are the Trumpeters, Fantails, Long-faced Tumblers, Helmets, Quakers, Priests, Turbits, Jacobins, Magpies, Swallows, English Owls, Nuns, Archangels, Antwerp Carriers, etc.

As to which varieties are the most desirable for breeding will depend much upon the taste of the breeder, since each variety differs very essentially from every other, and individual tastes differ so widely. The varieties which are perhaps the most popular generally are the Pouters, Carriers, Short-faced, Fantails, Jacobins, although there are many others that may be equally desirable.



**Pouters.**—There are five varieties of Pouters, viz.: the blue-pied, black-pied, red-pied, yellow-pied, and white. They are very attractive birds when well bred, and possess one very peculiar characteristic, which consists of being able to distend or blow up what seems to be an immense crop, which gives them a very singular appearance,—hence the name pouters, or as they are also sometimes called, "blowers." They have a very upright carriage, tapering bodies, and long legs. These birds will become very tame when kindly treated, and seem to love to be petted.

**Short-faced Tumblers.**—There are a dozen or more varieties of the Short-faced Tumblers, of which the standard colors are Almond, Kite, Mottles in Yellow and Red, Agate Mottles in Yellow and Red, whole feathers in Yellow and Red, Dun, Grizzle, Blue, etc. This class of pigeons derive their name originally from the habit of turning a somersault backward in the air during flight. This propensity seems to be partially voluntary and again involuntary, or caused by some special excitement; as the bird has a short plump body, small head, and short wings and tail, the weight of the body would more easily turn it over than if the wings and tail were more lengthy. There are the Short-faced and Long-faced Tumblers; the latter are generally the birds that perform these somersaults best, although some of the short-faced varieties will compete with them in this respect. The Almond is the most popular variety. Tumblers are regarded by many as the most intelligent of all the pigeon race: they have a broad, high head, which has a prominent rise from the base of the neck, which is very short. They are beautiful in form and plumage, have a round, dignified carriage, and are active, but quiet in habit.

A breeder of these birds describes the plumage of the leading varieties as follows: "In Almonds, bright buff, intermixed with black and white throughout the entire bird, each

feather showing as near the three colors as possible. Kites should show a fiery glow throughout, and when held to the light with wings exposed, it presents a very deep mahogany shade of color, the deeper the better. Mottles should have rose or white mottling only on wings and not over the entire covert, a slight ticking of white through neck and head; tail some color other than white, the flight also same as body color. Agates run lighter in both flights and tail. Many are sometimes surprised in the change of a young Agate, expecting it to be a fine whole feather, but after the first moult it has entirely changed. The breeding of the Short-faced Tumblers is a sort of lottery, as no man can tell what such a bird will breed, neither can he say with certainty what color the young will really be until after it has moulted its nest feathers.

To be successful in rearing young birds, a supply of nurses or feeders must first be had, say two pair or more to each of Short-face, so that some will be nesting the same time as your Tumblers, to give you an opportunity to shift either eggs or young, and supply the Short-face with the feeders young, as it does not matter if they would not feed them over a week (as is generally the case), and by letting them do this you save your valuable birds. The best nurses for a Short-face are good Plain-face Balds; some use Turbits and do well with them, but as long as I can get the Bald-head I can ask for nothing that suits my wants better. I have tried other varieties and know from past experience."

**Carriers.** — There are four well known varieties of the carrier pigeon, black, blue, dun, and white, although we occasionally see the red, and some others less common. These birds have a form suited to rapid and extended flight, some of them performing almost incredible feats in aerial journeys. The body is long, with flights and tail long in comparison with the size of the bird, the shoulders wide, standing well out and on a horizontal line with the front of the breast; the thighs long, and strong, and muscular. This bird has two peculiar characteristics which give it a very singular appearance, viz., an immense beak, wattle, and a wide wattle around the eye. These fancy points frequently in aged birds make them unsightly objects. Before the days of steam navigation, railroad and telegraphic communication, the carrier pigeon was an important agent in the rapid delivery of important messages, its love of home and attachment to its mate and offspring having imparted the capability of training these birds for this purpose. On long distances, the birds are selected, if possible, that have young ones in their nests. The average rate of speed in these birds is about thirty miles an hour, although better records are frequently given, that of the noted and champion bird "Columbia" having been two hundred and thirty-seven miles in four hours and fifty-eight minutes. He also flew from Columbus, Ohio, to Hudson City, New Jersey, a distance of four hundred and seventy miles, air line, leaving Columbus at fifteen minutes past five o'clock in the morning, and reaching his home at eight o'clock on the following morning. Making due allowance for resting (since he could not fly during the night), this achievement makes Columbus the champion of the United States, having flown the longest distance in the shortest time. Although somewhat weary from his long flight, the first thing Columbus did on reaching his coop on that morning, was to seek his mate and caress her. Then he went for food, water, and the bath tub.

**Barbs.** — The Barb pigeon is supposed to have derived its name from an abbreviation of Barbary pigeon, since it was first introduced from that country. Its original color was either black or dun, although there were birds of both these colors. They are now found black, white, red, yellow, and blue. The head markings are the most distinctive features of this bird. The head should be large, broad across the top, the eye pearl, surrounded by a circular eye-wattle of a coral red color; beak short. The form of the bird should be a short neck widening towards the shoulders; breast broad; body plump; legs short. These birds

are quite hardy, are quiet in disposition, and not addicted to extensive wanderings when well cared for at home.

**Trumpeters.** — The note from which the Trumpeter derives its name is a kind of prolonged coo, somewhat resembling the sound of a trumpet in the distance; this is one of the essential characteristics of the bird, but the power of voice and frequency of this vocal exercise varies with different birds. There are several varieties, black, white, red mottled, black mottled, etc. They are beautiful and showy birds, having what is known as a crest or rose formed of feathers that protrudes in front of the head, and much resembles a rose in full bloom, the feathers forming the petals. When fully developed or developed in perfection, this rose hides the eyes of the bird, from a front view, and shows only the tip of the bill. A crown of feathers extends from ear to ear, turning upwards, which somewhat resembles a hood. The legs and feet are profusely feathered.

**Priests.** — There are four or more varieties of these birds, blue, black, red, and yellow being the most common. The head extending from a little below the bill is white, while the feathers at the base are turned up the same as in all crested pigeons, the remaining part of the plumage being red or black, etc., as the case may be.

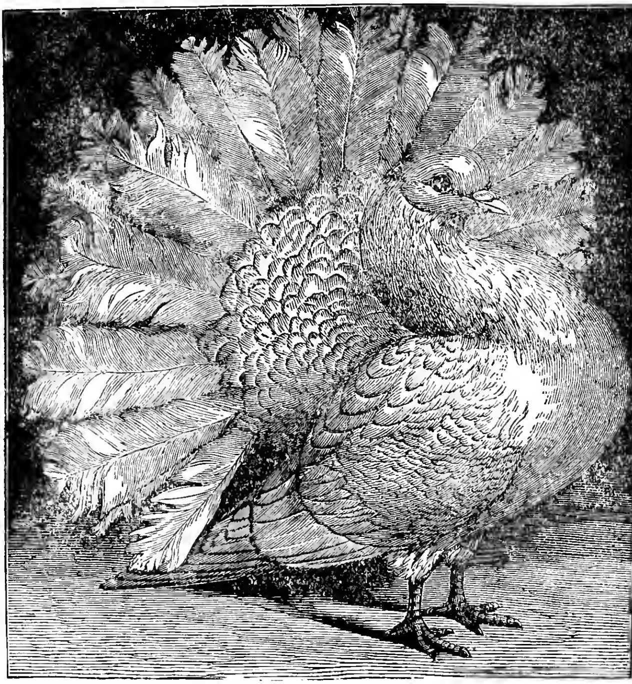
**Turbits.** — The colored varieties of Turbits are numerous, comprising black, red, yellow, blue, silver, dun checkered, blue with white bars, creamy, etc. Each of these colors is also bred as tail and wing Turbits, four styles of heads being recognized, viz., shell, point, peaked, and plain head, thus making the Turbit family a very extensive one. The peak crest is perhaps the most fashionable, and the hardest to get in perfection, yet the shell, point, and plain breeds are more common, and may be regarded as equally beautiful. "A shell crown should be of a perfect segment of a circle of upturned, inverted feathers, springing from the base of the skull below the ears, rising well up to a sharp, even line; clear and regular, and of about one inch in length. In all other respects, shell-crowned Turbits possess the same general properties, though the point crest is preferred." The color of the plumage in wing Turbits is represented by the color of the shoulder, the remainder of the plumage being pure white, while tail Turbits should have the tail correspond in color with the shoulder marking.

**Jacobins.** — The Jacobin pigeon derives its name from a French order of monks that wore hoods to cover their bald crowns. It has a range or ruff of feathers inverted around the neck from the wing buts, and extending up over the head in the form of a hood. The more compact and close-fitting the hood is, the more they are prized by fanciers. They are bred in plumage of red, yellow, black, blue, and white, and are quite common.

**Fantails.** — These beautiful birds have been bred very extensively in the past, and are at present great favorites, they being one of the most desirable of the fancy breeds. As the name indicates, they derive their appellation from the size and form of the tail, and the quivering or trembling of their necks. One strain of Fantails is quite large and erect, with very large tails, another is smaller and more stylish in form. They also vary in form, some birds having quite long necks, others being quite short-necked. The latter is the German variety. The pure white variety is the most common, although there are also the blue, silver, black, yellow, saddle backs, and frizzled. The yellow and blue varieties are quite rare. There is also the pure white with a slight purplish glimmer about the neck, which is very conspicuous when the bird is in the sunlight; there are occasionally seen black birds with a white tail, and white with black tails; but the pure white are the most beautiful. They cannot fly well, and stay about the yards and dove-cote more than any other breed.

Mr. J. M. Rutted says, in the *Poultry Monthly*, respecting this variety of pigeons:—

"The ideal Fantail of competent judges is a plain-headed pigeon uniting perfect 'Scotch' style and a typical 'English' tail. Few fanciers know how peculiarly difficult is the production of such a combination. *Fine* white smooth-head Fantails are one of the scarcest varieties of pigeons I know of. In an experience of over nine years, I have seen about a dozen which had a fair claim to being first-class, and I have made it my business to see every noted bird within reasonable distance, besides numerous visits to exhibitions. The most necessary point of the breed is a *short back*. Many breeders will differ from this, and put *tail* first, but unless the tail is carried squarely upright, no matter what its size, it never shows to any advantage, and a *lop*-tailed Fan is often beaten in the show-pen by a short-backed bird with half the



WHITE FANTAIL PIGEON.

spread Next in turn comes *spread* of tail, and *not* tail 'count.' Twenty-four feathers flatly expanded and forming three-quarters of a circle are much more valuable than thirty-six in that narrow 'stove-pipe' shape so much detested by veteran fanciers. And the actual *money* value of the former would be twice that of the latter, which fact may interest some pigeon keepers who look at the 'profits' only. Third in importance is *carriage*, *style*, *action*, or whatever term you are pleased to apply to continuous nervous motion, a well-expanded breast, a neat head and neck thrown well back and down to the root of the tail, and a succession of elegant curving outlines best described by that most significant word 'symmetry.' The feet and shanks as far as the knee-joint should be bright red and free from feather, but the best often have a few scattered tufts, showing that the Booted Fantail of India was probably one

of their ancestors. Wings must be carried easily below the tail and touching at the tips. If held up closely they spoil the shape of the tail by bending the lower feathers out of line, and as this fault is very hereditary, a Fantail so marred should not be used unless of necessity. The wing butts should be concealed by the small body feathers, and the whole feathering as tight as careful breeding combined with good condition can produce. Young birds do not have such graceful carriage of head and neck as their parents, being inclined to stand too erect, but with age fine-bred Fans, as a rule, gradually acquire the desired outlines.

The head, beak, and feet must be fine in shape and small sized. No Fantail coarse in these three points can possibly look high-bred. In mating for breeding I should use a good Scotch male of the most approved form and motion, with a tail well filled in the centre, and carried right up to its head. He should be clean footed and close feathered, but a good *spread* must not be expected, such stock, to the best of my belief, not being for sale. The hen must be chosen chiefly for shape, size, and fitness of *tail*, in which she ought to be especially fine to offset the deficiences of her mate. As *shape*, good or bad, is very hereditary, the most of their young will be apt to have the graceful bearing of the sire, and one or two may possess fairly excellent tails also

The best young cock may be bred next season with his mother, and in this way, there will be a fair prospect of breeding in one bird a grand *spread* and the desired *style* of the first Scotch cock. This system has resulted successfully in my own loft, and can be tried again by any fancier fortunate enough to get the required stock, in getting which all the difficulty lies. Fantails should not be bred so small as to have neither constitution nor tail. On the other hand, they must not be too large, since they are not judged by "size and weight." In keeping up a strain which will annually produce a large average of fine young, a most rigid system of selection and mating is necessary." These birds are very affectionate, and love to be petted.

**Other Varieties of Pigeons.** — The limits of this department will not admit of the description of an extended variety of pigeons; we will, therefore, add briefly but a few others to those already given. THE MAGPIE pigeon derives its name from its close resemblance to the bird of that name. It is bred in blue, black, yellow, and red colors, some of the varieties being very handsome. THE SWALLOWS are characterized by a skull cap and heavily-feathered feet and legs. Their points of marking are as follows: "First, the head; the upper mandible should be dark and the lower light; the scalp or top of the head in a line from the corners of the mouth across the eye, evenly marked, passing around to the back of the head, dark, but in those that are turned-crowned, the head must be perfectly white. Secondly: The wings of these should be wholly colored, without any white feathers, but the epaulets or scapular feathers which lie on the back, at the junction of the wing to the body, should be quite white, and as they overlay a part of the wing when closed, it necessarily appears narrow, which is considered a particular point. Thirdly: The feet, if shod, should be thickly covered with colored feathers from the heel or nack-joint to the toes; but the boots, or as Cochin fanciers would style it, the vulture-hock, must be white."

There are, in all, nine sub-varieties of this class of birds. THE OWL pigeon is closely allied to the Turbit, and derives its name from the form of its bill, which resembles that of an owl. The three classes of this variety are the English, the African or Foreign, and the Whiskered Owl. The English is the largest and most hardy. The Whiskered Owl derives its name from an extra development of frill, which consists of another frill crossing the one extending up the centre of the breast, and extending from side to side until it nearly meets behind the neck of the bird. The frill is one of the important points in these birds, and consists of tufts of feathers extending from the back to the lower part of the breast, and resembles the ruffle of the old-fashioned shirts worn by our ancestors in revolutionary times. In birds that are perfectly formed, this should be widely and evenly developed.

The feathers on the breast open and turn both ways, expanding something like the petals of a rose; this is called by some purle, and by others the frill, and the more the bird has of it, the better. These birds are apt to be a little wild, like the Carrier, and off their nests if disturbed while sitting; for this reason it is well to have the breeding places made so that they can have a secluded place for sitting.

The Nun is so called from its peculiar markings, the body always being pure white, with the head, tail, and flights of some solid color, such as black, red, yellow, or blue, they being generally preferred in the order given. The Archangel seems to differ in plumage from any other variety of pigeons; the head, neck, breast, and body, with the exception of the wings, are a rich copper color, while the tail and wings are a rich bronze black, the metallic

THE OWL PIGEON.

lustre reflecting in the sunlight the most gorgeous and beautiful tints. The Antwerps are noted for their homing characteristics, and for long and rapid flights.

**Management of Pigeons.** — Pigeons make beautiful pets, and may be kept with but comparatively little trouble. They differ very essentially from other domestic birds in respect to breeding, since as many different varieties as are desired may be kept together in one loft without danger of crossing, provided they have all been properly mated before being put in together. The foundation of success with pigeons, as with other feathered pets, is in strict attention to cleanliness. If the droppings are allowed to accumulate in the loft, the odor arising from them will be very injurious to the birds, causing them to become diseased; the filth also gets between the toes and on the feet of the birds, producing cracks and sores,

which in time will destroy the appearance and value of the birds. The floor of the pigeon loft should therefore be frequently cleaned and kept well sanded. Keeping dishes of water set about on the floor of the loft is also objectionable, for the birds wet their feet in the water and then track about over the droppings, which adhere to their feet, or else they upset the water and make the place wet. Pure, fresh water should always be kept by them in watering tanks of such a construction that they cannot be easily overturned. Pigeons drink early and often, and unless provided with a good supply of clean water will not thrive. A breeder of pigeons gives the following advice with respect to the food:

"In the matter of feeding, great care should be exercised, and only what food the birds will eat up clean and with an apparent appetite should be given. Sloppy food should never be given. When feeding moistened meal, or scalded meal, do not feed in such quantities that a lot is left on the floor, to heat and to cause the production of worms and insects innumerable. When feeding moistened food, it is best to use a small, shallow, wooden trough, from which the pigeons can readily take the food.

Almost all kinds of grain are relished by pigeons, such as wheat, rye, oats, barley, buckwheat, etc., while whole corn, though it is best not to feed too often or in large quantities, is much liked. Stale bread, moistened in fresh milk, is one of the best kinds of food for pigeons, keeping them looking sleek and glossy, while those breeds which are so short-billed or soft-billed as to eat whole grain with difficulty can readily eat this food. Lettuce is something of which pigeons are very fond. It should be hung up where they can peck at it at will, and should be freshly gathered daily for them. When possible, those who have the ground to do so should keep a supply growing all the year round, in the hot beds and cold frames, and the family as well as the pigeons can enjoy it. By keeping the birds tame, which every true fancier will do, there is no trouble in catching any of them when necessary, while they thrive far better than when kept wild."

Always give good, sound grain, and when corn is fed it should be that of some small-kerneled variety. Vetches or tares, small white pease, turnip seed, and millet are also good food for pigeons. Occasionally, though sparingly, hemp seed may be given. They should have finely-broken oyster shells kept by them at all times. Some breeders recommend that a large lump of rock salt be kept in the loft where they can have access to it, and which should occasionally be immersed in water for a moment or two and then left in its usual place. It is a good plan to have the nest boxes large enough to make two nests side by side in one box, since they frequently commence laying again before the young birds are ready to leave the nest. Tobacco stems make excellent material for building their nests, as they aid in exterminating vermin. Sulphur strewn in their nests is also excellent for the same purpose.


Imported Rough-Coated Scotch Collie, "CHAMPION TWEED 2d."


Champion "LASS O' GOWRIE."

 Both animals owned by T. H. Terry, New York City.

# DOGS.

THE dog belongs to a family that is widely distributed over nearly every portion of the globe, and is thought by many to have been the first animal ever domesticated by man. However this may be, we have no positive proof as to the fact. There is, however, abundant evidence to show that the dog existed in a domesticated state in prehistoric times, and we have no definite knowledge respecting its origin. It is supposed by some that all our present breeds of dogs have been derived from a single source, such as the wolf or jackal; others that they are the product of a blending and crossing of several distinct species, some of which may be living, others extinct. Others, still, regard them as the descendants of an extinct wild species. The most prevalent opinion entertained at the present day, however, is that the dog is the product of the crossing of several distinct species of animals. This opinion is based upon the fact of the many distinct breeds of dogs in the earliest historic period, these breeds so widely differing from each other, yet closely resembling wild animals of other species; the Esquimaux dogs, for instance, which closely resemble the wolf of that region in general appearance and voice; also the existence of wild species of dogs in all portions of the world, the fondness of man in a savage state for taming wild animals, etc. It is well known that even the most savage and degraded tribes of the human race all have dogs, and, notwithstanding they are often cruelly and brutally treated, they always entertain to a certain extent an attachment for their master and submission to his will that characterizes dogs bred by the more intelligent and civilized races of mankind. The dogs of savages, however, are lacking in that intelligence, faithfulness, and other desirable qualities that the improved and well-trained dogs of enlightened people possess, which shows that, like mankind, the dog is capable of a higher education, and that its intellectual and nobler qualities may be developed to an astonishing degree. The dog is universally conceded to be the most intelligent of the brute creation, and has long been the companion as well as faithful servant of man. Like the human kind, the dog is subject to all the varying passions, such as anger, jealousy, envy, hatred, love, and grief; while he also sympathizes with his master in joy or sorrow, is quick to anticipate his wants, and shows gratitude, pride, generosity, love of praise, fear, often a remarkable memory, and the exercise of those faculties which in man would be called reasoning powers, and which cannot, as is usually the case, be justly attributed merely to what is termed "instinct."

A certain French writer has said that "the best part of a man is the dog there is in him." It is certainly true that if, according to their intelligence, mankind were as faithful in the performance of duty as an intelligent and well educated dog, there would be less of deception, treachery, and evil of every form in the world than there is at present. Some one who evidently lacked a certain element of character essential to a just appreciation of what was noble in a dog, has said that "the best treatment for a dog was to cut off his tail behind his ears," a sentiment in which we cannot concur; and we doubt if there could be found many among the intelligent and thinking class of people that would endorse such an opinion, except as it were applied to the worse than useless curs that are so common in the country, and which have been such a nuisance to farmers in connection with sheep raising. A story is told of the faithfulness of a dog at the Mill River disaster that occurred at Williamsburg, Mass., several years ago, and which brought desolation and death to so many homes. A person who visited the scene of the disaster a few days after it occurred says:

"I shall never forget a scene I witnessed there during the search for bodies. The driftwood and *débris* had made a deposit beside a tree nearly twenty feet in depth, and there I saw a large dog crying pitifully. As we drew near we found that the dog was fastened down

by a stick of timber, and unable to move. His eyes were like balls of fire, and he was fearfully emaciated. At first we feared to go near him, but finally released him, and gave him some food. He dropped the food, looking down and whining.

'Some one is here,' one of our company said, and we commenced digging, and while doing so the dog lay very quiet; but the moment we ceased he seemed to grow almost frantic. When we commenced digging he laid down again, but no effort would induce him to taste the food before him. At last, after hours of labor, we found the body of an old man, and a little later a little boy, over which the faithful dog had been keeping watch. The joy of the poor brute was great, but the food which he had so generously refused would never be eaten by his young master.

'This story interested me greatly,' said my friend, 'for I knew the dear little boy who went out with his faithful dog to the meadows that dreadful morning, and the kind old man, his grandfather, who, hearing that the terrible flood was coming, went out to seek him.' They were all swept away; but the marvel was, how they kept together during that fearful four miles, and how the poor dog should know they were buried deep below him."

A good dog is a valuable servant and faithful friend, and deserving of the kindest treatment and consideration of his master. Dr. Holland has beautifully illustrated this idea in the following poem addressed to his dog.

## TO MY DOG "BLANCO."

My dear, dumb friend, low lying there
A willing vassal at my feet,
Glad partner of my home and fare,
My shadow in the street.

I look into your great brown eyes,
Where love and loyal homage shine,
And wonder where the difference lies
Between your soul and mine!

For all of good that I have found
Within myself or human kind,
Hath royally informed and crowned
Your gentle heart and mind.

I scan the whole broad earth around
For that one heart which, leal and true,
Bears friendship without end or bound,
And find the prize in you.

I trust you as I trust the stars;
Nor cruel loss, nor scoff of pride,
Nor beggary, nor dungeon bars,
Can move you from my side!

As patient under injury
As any Christian saint of old,
As gentle as a lamb with me,
But with your brothers bold;

More playful than a frolic boy,
More watchful than a sentinel,
By day and night your constant joy
To guard and please me well.

I clasp your head upon my breast—
The while you whine and lick my hand—
And thus our friendship is confessed,
And thus we understand!

Ah, Blanco! Did I worship God
As truly as you worship me,
Or follow where my Master trod
With your humility,

Did I sit fondly at His feet,
As you, dear Blanco, sit at mine,
And watch Him with a love as sweet,
My life would grow divine!

The great naturalist, Cuvier, regards the domestic dog as "the most useful conquest that man has gained in the animal world." It matters not whether his master be rich or poor, each individual dog defends his person and his goods, tracks him through the crowded street, distinguishes his voice from all others, and remains his faithful servant and companion even unto death; not from constant fear or necessity, but simply from true gratitude and affection. Instances are not uncommon where at the death of his master the dog refuses to be consoled, pines, and finally dies of grief. The dog is also the only animal capable of defending his master against other animals, or enemies of any kind, while he guards his

flocks and home, performing the duties of shepherd, drover, sportsman, and protector, remaining at all times his sagacious and faithful friend.

**Varieties of Dogs.**—The varieties of domestic dogs are very numerous, and as they are formed by crossing, there is scarcely any limit to the number that might be produced. According to Professor Fitzinger there are at least one hundred and eighty-nine distinct varieties of dogs. Considerable difference of opinion exists with regard to the method of grouping the different varieties, some depending to a certain extent upon the development of the ears, others upon the formation of the head, the length of the muzzle, etc. Thus dogs having the head, and especially the muzzle lengthened may constitute one group or class, such as the Greyhound, the Italian Greyhound, the Scottish and Irish Deer Hounds, the Albanian Hound, etc. Second, those having the head and muzzle less elongated than the former, which class comprises the most useful and intelligent of the whole race of dogs, such as the Scotch Collie or Shepherd Dog, Hound, Spaniel, Setter, Pointer, Newfoundland, and St. Bernard. Third, all those having the muzzle shortened, and the top of the head elevated, which class includes the Terrier, Bull Dog, Mastiff, and Pug Dogs.

Other classifications may be made according to the peculiar characteristics of the varieties: thus the Shepherd or Collie Dog belongs to the Spaniel class, remarkable for intelligence, sagacity, and affectionate attachment to its master. The Mastiff and other large, short-tailed dogs noted for their strength and courage may also constitute a class by themselves; while those noted for fleetness, such as the Greyhound, Deerhound, Foxhound, Bloodhound, etc., constitute another class, and so on. The most common class of dogs at the present time is the mongrel race known as Curs, which belong to no particular breed, but are the result of chance crosses. Although an occasional good animal may be found among these nondescripts, they are, as a general rule, practically worthless, and too frequently a common nuisance to farmers, being addicted to sheep killing and other dog vices, which would render their extermination a blessing as well as a necessity in some localities.

Dogs may be grouped, for convenience, into four classes, viz.: Watch Dogs, or those that are kept to guard property, such as the Mastiff, St. Bernard, Newfoundland, Shepherd, Drover's Dog, and the Bull Terrier; sporting or field dogs, such as the Pointers and Setters; dogs of chase, including those that follow the game by scent or sight, such as the different varieties of the hound; pet and toy dogs, such as the Black-and-tan Terrier, Scotch, Yorkshire and Skye Terrier, the Italian Greyhound, King Charles Spaniel, Poodle, Pug, etc.

**Dogs Useful to the Farmer.**—A good dog is of great value on the farm, and may be taught to be serviceable in many ways. We believe every farmer should own a dog, one possessing the most desirable qualities for the position, the same as any other farm animal, or help on the farm. In other words, dogs should be thoroughbred, like other valuable farm animals. When the useless curs so commonly seen in the country are exterminated, and well bred and well trained dogs are permitted to take their places, there will be less complaint among farmers about not being able to raise sheep on account of such nuisances, and no necessity of instituting dog laws for sheep protection, since the dog will then be an assistant to the farmer in guarding and caring for his flocks, instead of making ravages upon them. What would the shepherds of Scotland do without their faithful Collies? The Ettrick Shepherd avers that "the whole of the open mountainous land of Scotland would not be worth a sixpence without them."

Every breed is more or less valuable, from the Shepherd Dog who faithfully performs his duties to his master's flock, the shaggy Esquimaux that draws the sledge over long and weary roads, the Newfoundland that is a protector as well as a rescuer of life, the dignified Mastiff, the sagacious and intelligent St. Bernard, that guards the house and its surroundings from all intruders, the Pointer and Setter that are of such valuable service in securing

game, down to the little diminutive and ever active Terriers that rid the premises of rats and other vermin, and always give the shrill bark at night if there is any danger from intruders, and thus are among the best of Watch Dogs for signaling danger,—all possess desirable qualities of greater or less value to their master, and for the respective positions to which they are adapted, will prove valuable servants.

A good dog for the farm should be a faithful watcher, to guard the premises night and day; he should be kind in disposition, obedient, gentle to the farm stock, intelligent so as to understand what is required of him, and know his master's stock and premises, and also a good ratter, as well as an exterminator of foxes, skunks, weasels, etc. The dog that combines these qualities in the most satisfactory degree will prove the most useful to the farmer. As to which of the valuable breeds are the most useful on the farm, opinions differ. Many prefer the Scottish Collie.

A gentleman in Canada says on the subject: "I am satisfied that no breed of dog is so useful on the farm as a pure Collie. The breed we have will bring the cows home to be milked and drive them back to pasture; find the sheep and bring them to their enclosure every evening; is remarkably fond of children, but does not like cats. We live some two miles from a post-office, and on mail day our Collie will go and bring the papers and letters just as safely as any man would do it. We have a harness for him; it goes around the neck and fastens around the body, with a pocket on either side, having a flap buckled over. Then he gets on his brass collar with pointed edges, as a protection from other dogs on the road, very few of which will come near this dress. Before starting he has a lunch, and is promised a good dinner if smart back. About twenty minutes is the time he takes to do the message, unless delayed at the office, where he announces his arrival with a loud bark. In the busy time of spring and harvest, this letter-carrier proves a great advantage."

Some have a decided preference for the Mastiff. A writer in N. Y. gives his opinion as follows: "I have had some experience in the line of useful dogs, and am decidedly in favor of the Mastiff. The mastiff is a noble looking animal, large, kind, very affectionate, and not inclined to wander about the country miles from home. He is intelligent and very domestic, and as a rule is fond of children. I have one at the present time, a little over a year old. He is a very large and powerful dog, but my little six-year-old girl controls him perfectly, and when on the street he always seems to take delight in guarding her from danger, taking the outside or more exposed position. She has taught him to shake hands, sit on a chair, lie down, roll over, play 'possum, fetch and carry, and his extreme good nature is remarkable. Still he has courage, and if a strange dog comes near the child, or approaches the house, he must retreat at once or take a shaking up. We vote for the Mastiff."

Dr. A. S. Heath, in a paper read before The Farmer's Club in N. Y., expresses his preference in favor of the Fox Terrier. He says: "The Fox Terrier is a small dog, weighing from eighteen to twenty-five pounds. He is active, intelligent, kind, vigilant, obedient, cleanly, honest, faithful, healthy, and capable of performing his work in the most satisfactory manner. No stray animal can invade the premises with impunity day or night. Every unusual noise must be accounted for. The derangements of the house and barns are learned by him and reported by him in a business way. Foxes, skunks, rats, weasels, minks, stray cats, and all other marauders are expelled from the premises on the pain of death. In a word, I regard the Fox Terrier as the most suitable dog for the farm."

In our opinion, although some other breeds may prove very valuable for all practical purposes on the farm, the Scotch Collie has no equal is this respect, especially when well trained to assist in caring for the stock.

**The Mastiff.**—This is a noble breed of dogs, although the pure-blooded animals are quite rare, probably owing to their great size and the consequent expense of keeping; also to the fact that modern safeguards for the protection of property have rendered them less

essential than formerly. The English mastiff belongs to a race of great antiquity. More than three hundred years ago Conrad Herebatch, a writer of that time, described him as—"Neither too gentle, nor too curst; that he neither faune upon a theefe, nor flew upon his friends; very waking; no gadder about, nor lavish of his mouth, barking without cause; neither maketh it any matter though he be not swift, for he is but to fight at home and give warning of the enemie." He is a fine looking animal, possessing the dignified bearing that reminds one of a lion, while he is docile, companionable, intelligent, and courageous, though not ferocious.

When crossed with the Newfoundland or Bloodhound, the offspring are apt to be ferocious; and when crossed with the bull-dog, they are often exceedingly savage and dangerous brutes. The points of the mastiff are as follows: Head large in size, in shape between that of the bloodhound and bull-dog, having the volume of muscle of the latter, with the flews and muzzle of the former, though not as deep; ears small in size, drooping like those of the hound. The teeth usually meet, but there is generally a slight projection of the lower jaw; eye rather small or medium in size; the loins are compact and powerful, limbs strong, coat smooth; the most desirable color is red or fawn, with black muzzle; the tail is but slightly rough, and carried high over the back when under excitement; voice very deep and sonorous; height about twenty-eight to thirty-two inches. There are many smooth-haired dogs of large size that are frequently erroneously called mastiffs, but which are only mongrels, possessing, perhaps, some mastiff blood.

**The Newfoundland.**—There are three classes or varieties of the Newfoundland dog considered pure, all of which were originally natives of Newfoundland, viz.: the true Newfoundland, the large, long-haired variety, commonly known as the Large Labrador, and the smaller variety, known as the St. John's or Lesser Labrador breed. In intelligence the three breeds are regarded as being about equal, all being celebrated for their faculty of being easily taught to fetch and carry things. This is frequently developed to a surprising degree. A friend of the writer had a dog of this breed that once returned two or three miles on the road to find a whip that had been lost at the commencement of a journey. Anything that has been handled by the master will be found by these dogs simply by the scent, they having sufficient intelligence to understand what is required of them when it has once been pointed out.

NEWFOUNDLAND DOG.

Both the large and small varieties are good water dogs, but the larger, having a more woolly coat, can best endure the wet and cold. They are known to have rescued many persons from drowning, their natural instinct for carrying being exceedingly valuable under such circumstances. They can swim with great speed, their large legs and feet enabling them to paddle with considerable force. One of the characteristic points of the true Newfoundland is great size, dogs of this breed often attaining the height of from twenty-eight to thirty inches, while they have been known to reach even thirty-four inches. An English writer gives a description of this breed as follows:

"The head of a Newfoundland is remarkably grand and full of character, while its expres-

sion is very benevolent. Across the eyes the skull is very broad, and he has a large brain. The forehead is frequently wrinkled; the eyes are small, but bright and intelligent; they are generally deeply set, but should not have a blood-shot appearance. The ears must be small, smooth, set low, and hanging close; they are very seldom set up, even when the animal is excited. Nose and nostrils large; muzzle long and quite smooth; mouth capacious; teeth level. The neck is naturally short. It is well clothed with muscle, as are the arms, legs, and forehand; but there is a slackness about the loin, which accounts for his slouching and somewhat slovenly carriage.

He is frequently short in his back ribs, and some of the largest dogs have a tendency to weakness in the back. The feet are long and strong, but the sole is not so thick as that of a well-bred pointer, nor are the toes so much arched as in the average of hunting dogs. This peculiar structure of the foot is adapted for his sledge work on snow, and accounts for his power in the water, and has given rise to the vulgar error that he is 'semipalmated.' The shaggy-coated Newfoundland has a smooth face, but within two inches of the skull the coat suddenly elongates, and, except that he is very clean to the angle of his neck, he is thoroughly feathered in his outline. His coat generally parts down the back, and this parting is continued to the end of the tail, which is bushy and carried very gaily. His hind legs are closely coated from the hock, and his feet all round are nearly as free of feathers as a cat's. The color is generally black; and a brown or brindled tinge is a valued characteristic of the true breed. The black and white is not considered as good." The neck has a ruff of hair, which also adds to its short appearance. There are many long-haired dogs improperly called Newfoundlands by persons not acquainted with the true characteristics of this breed, such dogs being only a mongrel race.

The *Large Labrador* has not so compact a frame as the true Newfoundland, being more loosely built, and the coat which is never wholly black, but more or less mixed with white, is longer, more woolly, and curly.

The *St. John's Newfoundland* or *Smaller Labrador* is rarely more than twenty-five inches in height, and usually considerably less. The head is larger in proportion to the size of the body than the Large Labrador; the ear somewhat fuller; neck longer, the body much more compact, and the hair shorter, glossy, and devoid of woolly texture; the tail is similar, but the hair is less woolly; the legs and feet are strong, and well adapted for work. The color is usually jet black, reddish brown being rarely seen.

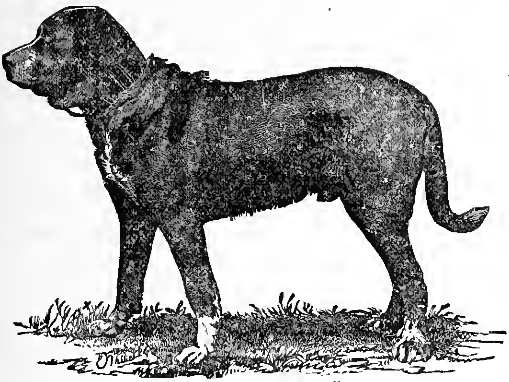
**The St. Bernard.**—This breed of dogs have long been world wide famous for their intelligence and sagacity in tracking and aiding benumbed travelers in the snow, they being trained to carry provisions, wine, and clothing on these expeditions of search for those who may be lost or overtaken in the violent storms so common in the region of the Alpine hospice, kept by the monks of St. Bernard. The dog of this breed, known as the "Good Dog Barry," is said to have saved the lives of over forty persons. There are two varieties of the St. Bernard dog, one long-haired or rough-coated, and the other smooth, the two varieties being similar in all respects except the hair. Of the rough-coated varieties those of a deep tawny brindle, relieved by some white, are most preferred. The smooth-haired variety are red and white in color, or brindle and white, with frequently a peculiar broad white collar about the neck, the latter marking being regarded by many as characteristic of the purity of the breed.

It is said that about seventy years ago the number of St. Bernard dogs was greatly reduced at the Hospice, owing to several casualties, and the monks were obliged to employ the female dogs for the hard service of rescuing travelers, and in consequence came near losing the breed. They introduced at that time a cross of a large, rough-haired breed, supposed to be Newfoundland, and thus originated the rough-coated variety. The marks preferred by the monks are a black or dark head, a white muzzle, the white marking running up over the head, white breast and collar, white feet or "stockings," and the tail tipped with

white. The above markings of the head and neck are preferred by the monks because they resemble the badge of the monk's order. Solid colored dogs are not uncommon.

The St. Bernard dog is remarkably pleasant in disposition, and may be trusted with women and children with the greatest confidence, towards whom he seems to take the part of a self-appointed guardian. Their principal characteristics are a large head, majestic and intelligent appearance; eyes rather deep, with a furrow extending between them up to the skull; lips pendulous; general form well proportioned. The height is from twenty-eight to thirty-one inches; the length six feet, including the tail. They have a keen scent, unusual quickness of perception, and remarkable powers of endurance. The valuable dog "Monk," owned by Mr. D. P. Foster, of New York, and said to be the largest St. Bernard in the country, died a short time since. Mr. Foster says of him:

"I brought Monk from the monastery of St. Gothard, in Switzerland, last August. He cost me $500, but I have since refused $800 for him, and I valued him at $1,000. He weighed about 170 pounds, stood thirty-four inches from the shoulder to the ground, and measured six feet nine inches from his nose to the tip of his tail. He was two years old, of a tawny lion color, with large, lustrous, kindly, nazel eyes, a heavy, drooping jaw, and huge, overlapping upper lip. His frame was massive, and his face beamed with intelligence. When reared upon his hind feet he looked enormous and fierce, yet he had such a gentle and kindly nature that children delighted to play with him, and he with them. Every day I took him out into Washington Square for his airing, and he was a great favorite with the nurses and children, and would poke his nose into every baby carriage that came near. He was a pure, rough-coated St. Bernard. His father and mother are yet employed by the monks of St. Gothard in hunting the mountain passes in search of unfortunate travelers. They are named Jungfrau and Monk, and they distinguished themselves in 1871 by saving the lives of several of a large party of monks, guides, and travelers who were buried in an avalanche.



ST. BERNARD, "DON,"
Owned by Mr. John P. Haines, New York City.

He was a dog of exemplary behavior. No man could enter the house at night without his permission, and none could go out unless I was there to give my consent. He was obedient, would fetch and carry, shake hands, lie down for the children to play with him, and give his old mountain howl of distress if he wanted help. He would not go out in the street unaccompanied, and then only after his toilet had been properly made — his face washed and his hair combed. He understood simple commands in three languages — Latin, French, and English. If there was a noise at the front door, he would be the first there. If the bell rang in the night, he would come and wake me up by scratching at the door. Monk had one peculiarity; he did not like soldiers, and when he met one he would step back and crouch as if ready for a spring. The reason of it was that he had been struck when young by a soldier. He always seemed to remember that blow, the monks said, and I found it true. He always reminded me of the lines that I once saw on a picture of old Monk, his father:

'In joy and sorrow I am my master's friend,
Honest and faithful, bribeless to the end.'"

## COLLIES.

COLLIES, commonly known as Shepherd dogs, also Scotch collies, are at present the most extensively bred of any of the canine family, which is probably due to their being the most useful dog generally to the farmer and ranchman in the assistance they render in the management of sheep and cattle, their intelligence, docility, and strong natural instincts for the care of stock, making their training for these duties a comparatively easy task; and having once learned what is required of them they never forget, but are faithful and untiring in its performance. To the shepherd in wild, mountainous localities, they are indispensable. In many portions of Europe, where large flocks of sheep are under the care of but one shepherd, they are often allowed by the aid of these dogs, to roam over vast territories, often in places so rough as to be inaccessible to man, yet these sagacious animals will follow them all day, and become so familiar with the members of their own flock, that they will not permit them to intermingle with other flocks that may be grazing in the same locality, but keep them entirely separate. It is not an uncommon occurrence to see a flock of sheep and goats in the mountains of Switzerland and Scotland under the entire care of dogs, who thus watch them during the day and drive them into the folds at night. Being so constantly with their master, and receiving such perfect training from him for their duties, has, according to the natural laws of transmitted characteristics, greatly increased the intelligence of this breed, which, combined with the care exercised in selecting the best specimens for perpetuating it, has vastly improved the collie, so that he now stands first in intelligence and sagacity among his race. In disposition he is docile and tractable, and always seems anxious to obey his master's orders, and will watch for every sign and gesture from him when he has once learned their meaning; in fact, he evidently takes pleasure in being useful, and although he may readily be taught to perform tricks for the amusement of spectators, he never seems to enjoy the sport, although he will do this to please his master, yet is apt to get sulky and show displeasure when required to repeat them many times, evidently regarding it as an imposition upon his dogship; but when called upon to serve his master in his own especial duties, he will be faithful unto death if necessary. The intelligence of these animals is truly astonishing, and the authentic anecdotes related of them often so wonderful as to seem incredible.

It is related of a Scotch shepherd who had in his charge seven or eight hundred sheep, that one night as he was quietly driving home his flock as usual, a terrific thunder-storm burst upon them, which so frightened these naturally timid creatures that a regular stampede was at once instituted, and away the whole flock went rushing and scampering back into the hills. It was too late to follow them, and if the disheartened shepherd could have done so, it would have been an impossibility for him to have restored order to so large a number and directed the flock homeward to the fold again. Not knowing what to do, the poor man turned to his favorite dog, and in his Scotch dialect said,—"Sirrah, they are awa!" In an instant the dog was off; it was so dark he could not tell which way he had gone, and as he did not return, the shepherd wandered about during the long hours of the night in the vain hope of being able to find the scattered portions of his disorderly flock; as dawn appeared, and the dog not returning, he decided to go at once and report the disaster to his master, when happening to look down into a valley near by he recognized, to his surprise and joy, his faithful "Sirrah" not with a portion only, but the entire flock, keeping them safely in charge. It is also related from authentic sources, that one of these dogs in England whose master was a cattle dealer, would drive a whole drove of cattle to a neighboring market unaided; and if he chanced to meet another drove on the road would so manage as to pass it without allowing his cattle to get mixed with the others. Another anecdote with respect to the collie, and one that seems almost past belief, is, that a sheep stealer in

Scotland had one of these dogs so well trained, that while walking among a flock of sheep he could designate by some sign the one he wished, and at night the dog would go into the fold and drive out that particular one to his master's flock.

The usual color of the collie is black and tan with a little or no white, but sometimes there is a deviation from this rule, some of the best dogs of this breed, and those that have often won high prizes at dog shows, having been a departure from this general rule, and are described in color as tawny red or tawny red and white, sable and tawny red, etc. The head of the pure collie is rather broad, the eye full, mild, and intelligent in expression, the ears pricked, small, and slightly falling at the tip. The body is well formed and finely proportioned. The coat consists of long, thick, woolly hair, which forms a complete protection against all vicissitudes of weather. The legs are of suitable size to well support the body. The tail is slightly curved and bushy, and is a very ornamental appendage to a truly handsome body, so that "all in all" our canine collie is not only one of the most useful, but also one of the most comely of his race. The illustrations which we give are presumably the best types of this breed in America, they being champion prize winners at both bench and field shows in this country, and having won numerous prizes in Europe before their importation, Tweed's prize winnings already amounting to over a thousand dollars. The color of Tweed 2d is black and tan with some white; that of Lass O'Gowrie tawny red and white. In order to improve the breed and training of collie dogs, and thus increasing their usefulness, field trials have been instituted within a few years, both in England and in this country, in which the intelligence and training of these dogs are tested in the management of sheep, where they are required to drive a small flock, usually strange sheep, into an enclosure for the purpose, strict time being kept, and the one that accomplishes this feat unaided in the shortest space of time is declared the winner. Sometimes the more difficult task of picking out his master's sheep from other flocks and driving them into the fold is given him to perform. We insert an account, from the *American Field*, of one of these trials that took place at Pittsburg, Pennsylvania, recently, in which Tweed 2d, the subject of our illustration, was winner.

"The trials commenced promptly Wednesday, at ten o'clock, sheep having been previously placed in the starting pen, five for each dog, and the route was laid out, from the starting pen down the track to near the quarter pole, where a turn was made, and the sheep driven back, past the starting point, and on around the track to a point opposite the quarter pole, when they were driven inside the field and penned in the folding pen, the entire route covering about one-half mile.

"Tweed 2d was called up first, and at the command from Mr. Phœbus, his handler, entered the pen and brought his five sheep out on the track, driving them over the route very leisurely, but securely. The sheep made several breaks, at one time running in opposite directions, but the champion showed himself to be master of the situation, and rounded them up in fine style, turned them into the open field, and got them safely to the pen, when fresh trouble commenced. He got two of them inside, when the others made a break across the ground, Tweed following them, and although he crippled himself in jumping a ditch, never faltered in his work until he got them back to the pen, when, as they still refused to enter, Mr. Phœbus called out, 'Speak to them,' and giving a short, sharp bark, the sheep quickly ran in and the gates were closed. Time, fourteen minutes and three seconds.

"Mr. Ralston's Jim was the next dog called. He started out very fairly, but his sheep becoming thoroughly demoralized, ran all over the grounds, and he failed to return with them, or pen them, which put him out of the race.

"Mr. Strean's Carlo came next, a fine looking dog, but laboring under the disadvantage of being entirely deaf, his handler working him entirely by hand signals. Taking his infirmity into consideration, this dog did very well, succeeding in penning his sheep in twenty-nine minutes and thirty seconds.

"Mr. Strean's Rover followed, and although he succeeded in bringing his charge safely to the folding pen, his handler was compelled to assist him in getting them to enter. He consumed over half an hour in performing his task.

"After dinner, Mr. Ralston's Waddie was called, a very handsome dog, but entirely new at the business he was called upon to perform. He was soon in deep water, and required the direct assistance of his handler to get his charge in shape again. He improved in his work as he progressed, but at the folding pen he again had to have help to make them enter. Time, eighteen minutes and four seconds.

"Dr. Downey's Scottish Maid came last, having to drive the same five sheep which had given so much trouble to Mr. Ralston's Jim in the forenoon. Taking into consideration the character of this flock, the Maid did by far the finest work of the trial. She was as quick as a flash, and her actions in handling her unruly charge called forth constant plaudits from the spectators. If the spectators had had the awarding of the prizes, she would have had first unanimously, and she would have won it any way if her sheep had acted as well as they did for the other dogs. As it was, she penned them in grand style in fourteen minutes and twenty-six seconds.

"The awards in the All-Aged class were as follows: First, Dr. J. W. Downey's Tweed 2d; second, Dr. J. W. Downey's Scottish Maid; third, Mr. J. G. Strean's Carlo."

The following account of a sheep dog's trial held at Darlington, Durham, England, as given by the *Darlington Times*, is also interesting in showing the sagacity of this breed of dogs, and the wonderful extent to which their training may be carried.

"This event was a source of considerable interest to visitors on Thursday, though the result was not satisfactory from a spectacular point of view. Five dogs were entered to compete, only three of them putting in an appearance. The trial consisted in turning four sheep out into the park at the lower end of the ground, the extent of which is probably three-quarters of a mile square, small plantations being studded here and there. A herd of cattle was also grazing in the park, which, as was proved in the course of the trials, somewhat increased the difficulties which the dogs had to overcome. In a circumference of about three-quarters of a mile blue banners were fixed, and the dogs had to drive the sheep around this circuit and pen them at the finish. At each side of the ring the flags were placed so near to the plantations that the space to be traversed by the sheep was narrowed to about the dimensions of a gate; and the rules prohibited the owner of the dog from going so near the animal as to be able to guide it, with his voice, or in any great degree with his actions. It is not the custom of dogs to drive their charges through boundaries of blue banners, and it will easily be imagined the intelligence and careful training requisite to enable them to understand what was expected of them.

"Of the three dogs competing, one had taken prizes in other parts of the country in similar exhibitions, though the other two came fresh from their practical duties. Rob, the property of Mr. J. Storey, Wolsingham, a lightly made black and white dog, in capital working condition, was put on his trial first. The sheep were turned into the park, and at a sign from his master he dropped out of sight in the long grass, where he remained until another movement of the hand sent him after the sheep. He got his charge safely past the first flag, but they scattered and went pell-mell about the field. The owner was fully one hundred and fifty yards away from the dog during part of the trial, but at this distance such was the implicit obedience of the animal that a sign would either stop him when at full speed, or start him in any direction to head the sheep. It took some twelve minutes to get the sheep around the flags. It was, however, eventually accomplished, but they were much punished with their incessant exertions. One of them was exhausted at the finish and obstinately squatted. The dog, however, at last got them together again, and drove them to the pen, three of them entering with comparatively little trouble. But one pugnacious specimen, probably incensed at having been so continually on the trot, refused to enter. It defiantly faced about, and,

instead of submitting to be driven, attempted to drive the dog, and it was not until his sheepship considered his dignity properly sustained that he went in among his brethren. This event was a source of considerable amusement among the spectators. The time occupied in penning the sheep was seventeen minutes. The dog worked most intelligently, and showed off his training in a marked manner. He gave voice but three times, and notwithstanding the great trouble he had with the sheep he evinced marvelous patience, never pressing them closely or chasing them needlessly.

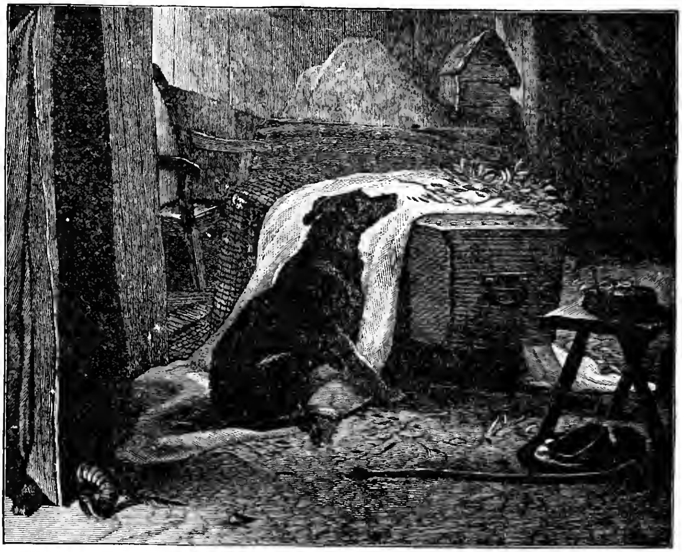
The second dog, Fly, belonging to Mr. R. Huck, Kendal, had had the benefit of experience in similar competitions, and it was thought he would win the prize. His efforts were, however, not nearly so successful as were his rival's, though he managed to get the sheep past the first two flags with little trouble. At the third, however, they broke away and made off up the park, becoming intermixed with a herd of black cattle. The dog fetched them back in a most sagacious manner, but he lost much time in getting them past the remaining flags. Eventually they were safely penned. This dog was not so fast, and did not yield immediate obedience to the gestures of his master, as did the first. He kept the sheep better together, showed equal patience and good temper, and generally furnished a capital illustration of the sagacity and intelligence of this favorite class of the canine race. The time he accomplished his work in was nineteen minutes.

Only another trial was made, this time by Mr. Wm. Lighthouse, of Northallerton's Rose. The animal was in bad condition, and, as a doggy man standing by put it, soon 'lost its wind.' It did not succeed in penning the sheep. The prize was most justly given to Rob, and this animal then furnished another instance of his intelligence. Eight sheep were then turned into the park, and he, in obedience to signs from his master, first divided them into two fours, keeping them separate for a time; then he halved one of the fours and kept them all separate, sitting quietly down to preserve their respective positions until his master walked between to count them."

A San Antonio (Texas) correspondent of the *Forest and Stream* gives the following account of a Collie puppy: "I have seen him, at a word from the shepherd, round up and put between sixteen and seventeen hundred sheep in a pen (many of them wild Mexicans), and not chase or crowd any of them. The little fellow would mass this large flock of scattered sheep and direct them toward the pen in half the time that several men could do it. When penning the sheep he had to work them down a long hill that sloped to a flat that the pen was built upon. When close in upon any portion of the flock, he could not see over them, he would scamper back up the hill and locate the position of the pen, and then flank his sheep according to his bearings. When the last sheep and frisky lamb was inside, he would sit down at the gate and slap the dust with his tail until the shepherd commenced putting up the poles that formed the gate, and I have seen him attempt to assist in that work by trying to drag the poles to the gate. At night he would keep the sheep in the pen, which consisted of brush, or if they broke out would promptly put them back. I have herded those sheep myself, and slept in a small tent a few yards from the pen. In case of the moon rising full, sheep appeared to take it for sunrise, and would break out. The first time it occurred during Dick's administration, Dick put his paws upon my breast and licked my face and awoke me. I said. 'Go for 'em, Dick!' and he did it and put the lost sheep back in the pen, and then came back and tried to tell me that all was right. After that night he needed no further hints, but took the business into his own hands, or paws. He had but little tuition, but he guarded that sheep pen as well as though he was five years of age instead of five months. If he had been guilty of any misbehavior for which he knew he deserved punishment, he would rush off and round up his flock of sheep as though he wished to show some work to atone for his misconduct. He had a nose like a bloodhound, and could follow a person's footsteps as well. I have left him asleep on the prairie more than once, stolen away and hidden myself, and watched

him follow my footsteps. He would trace every step until he found me, and then would quiver for joy."

The faithfulness of the Shepherd dog is remarkably exemplified in the following touching incident given by Dr. Dio Lewis: "One herder whom we met at Cold Spring ranch showed us a very pretty Collie dog that he said he would not sell for $500. She had at that time four young puppies. The night we arrived we visited his camp, and were greatly interested in the little mother and her nursing babies. Amid those wild, vast mountains, this little nest of motherly devotion and baby trust was very beautiful. While we were exclaiming, the assistant herder came to say that there were more than twenty sheep missing. Two male dogs, both larger than the little mother, were standing about, with their hands in their breeches, doing nothing. But the herder said neither Tom nor Dick would find them. Flora



THE HIGHLAND SHEPHERD'S CHIEF MOURNER. By Landseer.

must go. It was urged by the assistant that her foot was sore, she had been hard at work all day, was nearly worn out, and must suckle her puppies. The boss insisted that she must go. The sun was setting. There was no time to lose. Flora was called, and told to hunt for lost sheep, while her master pointed to a great forest, through the edge of which they had passed on their way up. She raised her head, but seemed very loath to leave her babies. The boss called sharply to her. She rose, looking tired and low-spirited, with head and tail down, and trotted off toward the forest. I said: 'That is too bad.' 'Oh, she'll be right back. She's lightning on stray sheep.' The next morning I went over to learn whether Flora found the strays. While we were speaking the sheep were returning, driven by the little dog, who did not raise her head or wag her tail even when spoken to, but crawled to her puppies and lay down by them, offering the little empty breasts. She had been out all night, and, while her hungry babies were tugging away, fell asleep. I have never seen any-

thing so touching. So far as I was concerned, 'there was not a dry eye in the house.' How often that scene comes back to me — the vast, gloomy forest, and that little creature, with the sore foot and her heart crying for her babies, limping and creeping about in the wild cañons all through the long, dark hours, finding and gathering in the lost sheep!

I wonder if any preacher of the gospel ever searched for lost sheep under circumstances so hard and with such painful sacrifice? But then we must not expect too much of men. It is the dog that stands for fidelity and sacrifice." Another incident of a similar kind is derived from an equally authentic source: "A shepherd lost his large flock on the Scotch Mountains in a fog. After fruitless search he returned to his cottage, bidding his Collie find the sheep if she could. The Collie, who was near giving birth to her young, understood his orders and disappeared in the mist, not returning for many hours. At last she came home in miserable plight, driving before her the last stray sheep, and carrying in her mouth a puppy of her own! She had of necessity left the rest of her litter to perish on the hills, and in the intervals of their birth the poor beast had performed her task and driven home the sheep. Her last puppy only she had contrived to save.

**Spanish Shepherd Dog.** — This variety of the Shepherd dog is sometimes called the "wolf-dog," being much larger, stronger, and swifter than the Collie. It is employed quite extensively in Spain in watching the mountain flocks. Although gentle in disposition, he will fight with desperate courage when it is necessary. This dog partakes something of the setter type, and also slightly resembles the Collie. The limbs are clean and long, hair of medium length, ears drooping, tail slightly bushy.

**German Sheep Dog.** — This dog closely resembles the Spitz, though considerably smaller in size, and as a pet dog is much safer than the latter, being more amiable and affectionate in disposition. He has upright ears, a short muzzle, shaggy hair, and a bushy tail that he carries directly over his back. He is sprightly, intelligent, and tractable, and makes an excellent assistant for the shepherd.

**Pomeranian, or Spitz Dog.** — With the reputation of being snappish in temper and unsafe to be trusted with children, the Pomeranian or Spitz dog is much less popular than formerly. In their native country, they are employed as a sheep-dog, a position for which they are by nature admirably fitted, their long woolly hair furnishing an excellent protection against the wet and cold. He is like the Collie in being impatient of control in playing tricks, but unlike the latter he is cowardly, and prefers to run away rather than fight when the choice is given him. These dogs are very cleanly in their habits, and generally free from odors that most dogs have in their coat and breath. They have a beautiful coat of hair which is long, fine, and smooth, pure white in color, short muzzle, prick ears, and a bushy tail carried directly over the back.

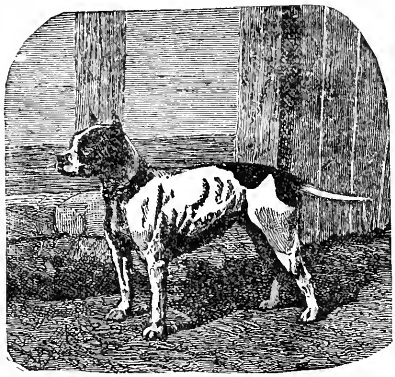
**The Bull-Dog.** — The Bull-dog is the most ferocious of all the canine race, and is also noted for great tenacity, being made to let go his hold with the greatest difficulty when once he has obtained the advantage. The chief characteristic seems to be sullen ferocity, and great muscular power. An English writer says of this breed: "The mental qualities of the Bull-dog may be highly cultivated, and in brute courage and unyielding tenacity of purpose he stands unrivaled among quadrupeds, and with the single exception of the game-cock, he has perhaps no parallel in these respects in the brute creation. Two remarkable features are met with in this breed: First, they always make their attack at the head; and, secondly, they do not bite and then let go their hold, but retain it in the most tenacious manner, so that they can with difficulty be removed by any force which can be applied.

Instances are recorded in which Bull-dogs have hung on to the lip of the bull (in the old days of baiting this animal) after their entrails have been torn out, and while they were in the last agonies of death. Indeed, when they do lay hold of an object, it is always necessary to

choke them off, without which resource they would scarcely ever be persuaded to let go. From confinement to their kennels, they are often deficient in intelligence, and can rarely be brought under good control by education. Owing to the same cause, they show little personal attachment, so that they sometimes attack their friends as well as their enemies, when their blood is up.

But, when differently treated, the Bull-dog is a very different animal, the brutal nature which he so often displays being mainly attributed to the savage human beings with whom he associates. Although, therefore, I am ready to admit that the Bull-dog often deserves the character for ferocity which he has obtained, yet I contend that this is not natural to him, any more than stupidity and want of affection, which may readily be proved to be the reverse of his character, if any one will take the trouble to treat him in a proper manner."

Cuvier avers that the Bull-dog has a brain that is smaller in proportion to his size than any other of his congeners, and thus accounts for his lack of sagacity. Other writers dispute this; however it may be, this dog is less valued than many other breeds for general purposes, but is useful for crossing upon the less courageous breeds and tender-mouthed dogs, in order to give them courage and holding qualities. The points of a well bred Bull-dog are as follows: Head round, skull high; eye medium-size, and the forehead well sunken between them; ears small and partially erect, placed rather close together; muzzle short and truncate; jaws heavy and strong; back short; chest deep and broad; legs strong and muscular. The coat should be fine and smooth, unmixed colors being preferred, such as red, fawn, blue smut, and white. This breed of dogs varies greatly in weight, the larger varieties sometimes weighing over seventy pounds. They should be strong and muscular, without an excess of fat, courageous without a blind, savage ferocity, intelligent, open-eyed, deep-voiced, and not over affectionate, as it is generally thought that the Bull-dog most demonstrative in affection, is the most liable to be treacherous.



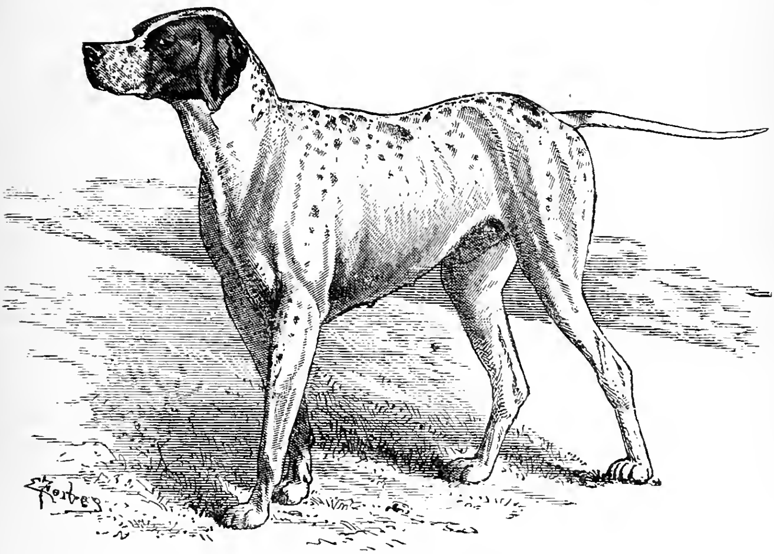
ENGLISH BULL-TERRIER.

**The Bull-Terrier.** — When properly bred, the cross between the Terrier and Bull-dog makes a valuable dog for all practical purposes, they being intelligent, obedient, affectionate, and courageous; in fact, a valuable house dog, as well as an exterminator of all that class of pernicious animals that are liable to infest the farm. A leading English authority says of them: "Many of our smooth Terriers are slight crossed with the Bull-dog, in order to give courage to bear the bites of the vermin which they are meant to attack. When thus bred, the Terrier shows no evidence of pain, even though half a dozen rats are hanging on to his lips, which are extremely tender parts of the body, and where the bite of a mouse even will make a badly bred dog yell with pain. In fact, for all the purposes to which a Terrier can be applied, the half or quarter cross with the Bull, commonly known as the 'Bull-Terrier,' or 'half-breed dog,' is of more value than either of the purely bred progenitors.

Such a dog, however, to be useful, must be more than half Terrier, or he will be too heavy and slow, too much under-jawed to hold well with his teeth, and too little under command to obey the orders of his master. Sometimes the result of the second cross, which is only one-quarter Bull, shows a great deal of the shape peculiar to that side; and it is not until

the third or fourth cross that the Terrier shape comes out predominant. This is all a matter of chance, and the exact reverse may just as probably happen, although the Terrier was quite free from the stain of the Bull, which is seldom the case.

The points of the Bull-Terrier vary in accordance with the degree of each strain in the specimen examined. There should not be either the projection of the under jaw, or the crooked fore legs, or the small and weak hind-quarters; and until these are lost, or nearly so, the crossing should be continued on the Terrier side. The perfect Bull-Terrier, may, therefore, be defined as the Terrier with as much Bull as can be combined with the absence of the above points, and showing the full head (not of course equal to that of the Bull-dog), the strong jaw, the well-developed chest, powerful shoulders, and thin fine tail of the Bull-dog, accompanied by the light neck, active frame, strong loin, and fuller proportions of the hind-quarter of the Terrier. A dog of this kind should be capable of a fast pace, and will stand



POINTER "RUSH," OWNED BY EDMUND ORGILL, BROOKLYN, N. Y.

any moderate amount of road work. The height varies from ten inches to sixteen, or even twenty. The color most admired is white, either pure or patched with black, blue, red, fawn, or brindle, sometimes black and tan, or self-colored."

**The Pointer.** — Among sportsmen, the Pointer and the Setter seem to be equally admired, they being the most beautiful and valuable of all sporting dogs. With the Newfoundland, St. Bernard, Collie, and many other varieties, they belong to the Spaniel class, yet the Pointer seems more remotely removed from this class than any other breed belonging to it. He possesses a more delicate scent than any other of the field dogs, and in pointing game he has no superior. They are exceedingly intelligent animals, and though taking naturally to the hunting and pointing of game, they must be carefully trained for this purpose, in order to be perfectly reliable. It is stated by reliable authority that both Pointers and Setters have been known to refuse to work longer when loaned to a poor marksman who made repeated

and ineffectual attempts to bring down the game, but would trot off towards home, and no coaxing or command would be effectual in bringing them back. Instances are on record where Pointers have stood motionless pointing the game for an almost incredible length of time.

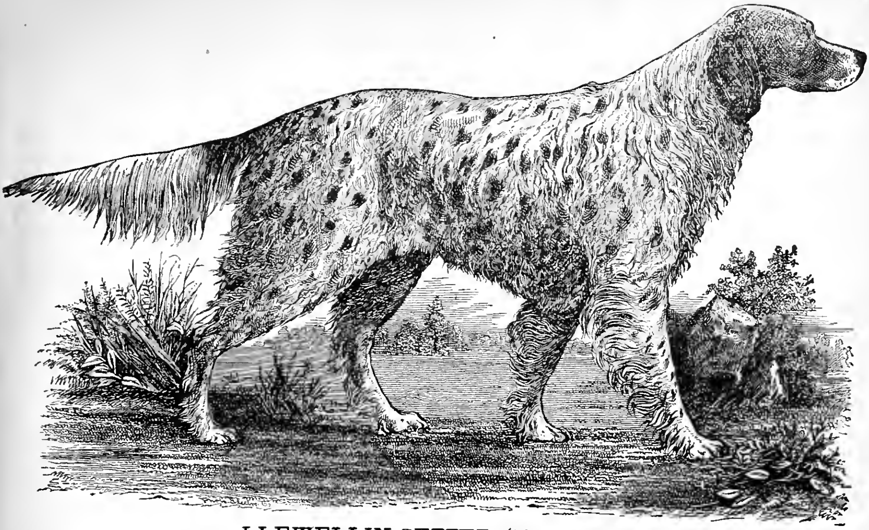
Thus one gentleman owning a brace of Pointers, tells of their standing motionless for an hour and a quarter, another for over two hours. In the latter case, which was a female dog belonging to a Mr. Lee, the animal stood with her hind legs on a gate just as she jumped over, where was a nest of partridges close to her nose. Her owner was out gunning with other dogs also, and did not miss his favorite Clio for a long time; finding she did not come at his call, he went back to look for her, and found her in that position; had she moved at all, she would have disturbed the birds. Mr. Lee's approach disturbed them, some of which he shot, but the poor dog was so stiff from her long standing in the same unnatural position, that she could scarcely move, and her master sat down on the grass and rubbed her legs until she could bend them freely.

The points desirable in the Pointer are a head of moderate size, rather wide, with a high forehead and intelligent eye. The muzzle should be broad, with the outline square in front, and not receding, as is the case with the hound. Flews not pendant. The head should be well set, the neck long, smooth, and convex in the upper outline. The body of good size and length, with wide chest and hips. The tail should be strong where it joins the body, suddenly diminishing, and continuing of the same size until within two inches of the tip, where it terminates in a sharp point. The absence of this characteristic is said to show a cross with the hound or some other breed. The shoulders are points of great importance in the Pointer, since unless well formed he will not have the endurance for long journeys or be quick in his work.

The blade should be long, slanting but muscular, the upper arm long, and fore-arm short, the elbow being well down below the chest. The legs should be strong, with a strong knee and ankle, the foot round, with a thick sole. The color is generally mainly white with a few small spots of some other color; white, with black, reddish, or yellow heads, are the most prized, since the white makes them more conspicuous, and they are not as easily lost sight of in pointing as those of a dark color or black. The previous illustration of the noted pointer, "Rush," is a fine type of the breed. This dog has taken the first prize repeatedly at shows in different parts of the country, and is remarkable for combining in an unusual degree, intelligence, patience, firmness, gentleness, and good judgment.

**The Setter.**—The Setter is, without doubt, descended from the Spaniel, or both are derived from the same parent stock. He has no superior in intelligence and value as a field dog, being remarkably intelligent, affectionate, and docile, beside not lacking in courage. A well trained setter makes a most reliable house dog, as well as trusty and efficient helper in the field. The original colors were chestnut, dark bay, and white.

**The English Setter.**—There are many different strains of the English Setter, all differing in a greater or less degree. They are generally white, with black or brown marks. The Gordon Setter, which is an English strain, is black, or black with a tinge of brown or tan; the black should be a jet black without mixture, and the tan a dark mahogany color. This strain is heavier built, and has not so fine breeding as the white and brown English or the Irish Setter. The Llewellen Setter is a pure English Setter, made up from the Laverack, Southesk, and Gordon crosses. The strain goes back on the Southesk-Gordon side of the breed to the Dulse-Rhoebe cross, which, with the Laverack for a basis, was the starting point of Mr. Llewellen, the originator of the strain. The illustrations of this variety on a previous page are made from photographs of animals that have won many prizes at shows, and are fine types of the strain.



LLEWELLIN SETTER, "CRACK."


LLEWELLIN SETTER, "DIANA."
Both animals owned by T. F. Taylor, Richmond, Va.

**Points of the English Setter.**—The points of the English Setter as derived from English sources are as follows: *The Skull.*—The skull has a character peculiar to itself, somewhat between that of the pointer and cocker spaniel, not so heavy as the former's, and larger than the latter's. It is without the prominence of the occipital bone so remarkable in the pointer, is also narrower between the ears, and there is a decided brow over the eyes.

*The Nose.*—The nose should be long and wide, without any fullness under the eyes. There should be in the average dog setter at least four inches from the inner corner of the eye to the end of the nose. Between the point and the root of the nose there should be a slight depression—at all events, there should be no fullness—and the eyebrows should rise sharply from it. The nostrils must be wide apart and large in the openings, and the end should be moist and cool, though many a dog with exceptionally good scenting powers has had a remarkably dry nose, amounting, in some cases, to roughness like that of shagreen. In all setters the end of the nose should be black, or dark liver-colored, but in the very best bred whites, or lemon and whites, pink is often met with, and may be pardoned in them. The jaws should be exactly equal in length, a "snipe nose," or "pig jaw," as the receding lower one is called, being greatly against its possessor.

*Ears, Lips, and Eyes.*—With regard to ears, they should be shorter than the Pointer's, and rounded, but not so much so as those of the Spaniel. The "leather" should be thin and soft, carried closely to the cheeks, so as not to show the inside, without the slightest tendency to prick the ear, which should be clothed with silky hair little more than two inches in length. The lips also are not so full and pendulous as those of the Pointer, but at their angles there should be a slight fullness, not reaching quite to the extent of hanging. The eyes must be full of animation, and of medium size, the best color being a rich brown, and they should be set with their angles straight across.

*The Neck.*—The neck has not the full rounded muscularity of the Pointer, being considerably thinner. but still slightly arched, and set into the head without that prominence of the occipital bone which is so remarkable in that dog. It must not be "throaty," though the skin is loose.

*Shoulders and Chest.*—The shoulders and chest should display great liberty in all directions, with sloping deep shoulder blades, and elbows well let down. The chest should be deep rather than wide.

*Back, Quarters, and Stifles.*—An arched loin is desirable, but not to the extent of being "roached" or "wheel backed," a defect which generally tends to a slow up-and-down gallop. Stifles well bent, and set wide apart, to allow the hind legs to be brought forward with liberty in the gallop.

*Legs, Elbows, and Hocks.*—The elbows and toes, which generally go together, should be set straight; and if not, the "pigeon-toe" or inturned leg is less objectionable than the out-turn, in which the elbow is confined by its close attachment to the ribs. The arm should be muscular, and the bone fully developed, with strong and broad knees, short pasterns, of which the size in point of bone should be as great as possible (a very important point), and their slope not exceeding a very slight deviation from the straight line. Many good judges insist upon a perfectly upright pastern, like that of the Fox-hound; but it must not be forgotten that the Setter has to stop himself suddenly when at full stretch he catches scent, and to do this with an upright and rigid pastern causes a considerable strain on the ligaments, soon ending in "knuckling over;" hence a very slight bend is to be preferred. The hind legs should be muscular, with plenty of bone, clean, strong hocks, and hairy feet.

*The Feet.*—The feet should be carefully examined, as upon their capability of standing wear and tear depends the utility of the dog. A great difference of opinion exists as to the comparative merits of the cat and hare foot for standing work. Fox-hound masters invariably select that of the cat, and as they have better opportunities than any other class of insti-

tuting the necessary comparison, their selection may be accepted as final. But as Setters are specially required to stand wet and heather, it is imperatively necessary that there should be a good growth of hair between the toes, and on this account a hare foot, well clothed with hair, as it generally is, must be preferred to a cat foot, naked, as is often the case, except on the upper surface.

*The Tail.*—The flag is in appearance very characteristic of the breed, although it sometimes happens that one or two puppies in a well-bred litter exhibit a curl or other malformation, usually considered to be indicative of a stain. It is often compared to a scimitar, but it resembles it only in respect of its narrowness, the amount of curl in the blade of this Turkish weapon being far too great to make it the model of the Setter's flag. Again, it has been compared to a comb; but as combs are usually straight, here again the simile fails, as the Setter's flag should have a gentle sweep; and the nearest resemblance to any familiar form is to the scythe with its curve reversed. The feather must be composed of straight, silky hairs, and beyond the root the less short hair on the flag the better, especially towards the point, of which the bone should be fine, and the feather tapering with it.

*Symmetry and Quality.*—In character the Setter should display a great amount of "quality," a term which is difficult of explanation, though fully appreciated by all experienced sportsmen. It means a combination of symmetry, as understood by the artist, with the peculiar attributes of the breed under examination, as interpreted by the sportsman. Thus a Setter possessed of such a frame and outline as to charm an artist would be considered by the sportsman defective in "quality" if he possessed a curly or harsh coat, or if he had a heavy head with pendent bloodhound-like jowl and throaty neck. The general outline is very elegant, and more taking to the eye of the artist than that of the pointer.

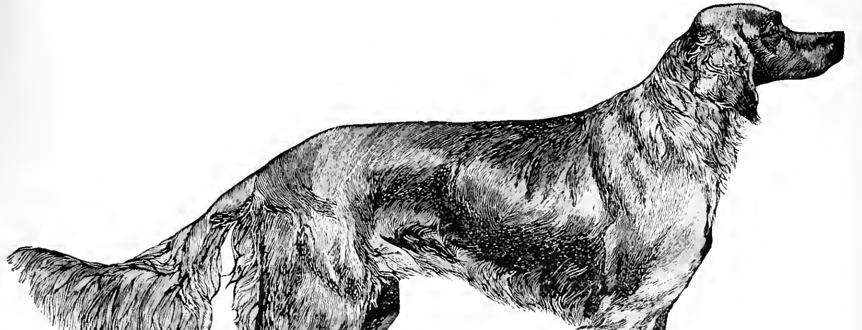
*The Hair.*—The texture and feather of coat are much regarded among setter breeders, a soft, silky hair without curl being considered a *sine quâ non.* The feather should be considerable, and should fringe the hind as well as the fore legs.

*Color.*—The color of coat is not much insisted on among English setters, a great variety being admitted. These are now generally classed as follows, in the order given: (1) Black and white ticked, with large splashes, and more or less marked with black, known as "blue Belton;" (2) orange and white freckled, known as orange Belton; (3) plain orange, or lemon and white; (4) liver and white; (5) black and white, with slight tan markings; (6) black and white; (7) liver and white; (8) pure white; (9) black; (10) liver; (11) red or yellow.

**The Irish Setter.**—This breed has great stamina and endurance, as well as valuable qualities in other respects, being sagacious, quick, courageous, and as good on the scent of game as sporting dogs will average. His style of moving is easy, with a free action of the shoulders, and his hind legs brought well under him. There are two varieties or strains of the Irish Setter, the red, and the white and red. "Rory O'More" and "Mag," illustrations of which are given, are both fine specimens of this breed, having won many prizes at shows. "Rory" made his first appearance in public as a show dog in New York under the auspices of the Westminster Kennel Club in 1877. Although then only nineteen months old, he carried away the first prize from a host of competitors On the same occasion a $250 cup offered for the finest specimen of a dog of any breed, including native or imported setters or pointers, was awarded to him.

"Rory" was again on the bench at the shows given in New York in 1879 and 1880, at both of which he was the captor of the highest honors, being awarded the championship again the first year, and the Tiffany necklace the second. He has since that time continued to maintain his good record in capturing prizes. "Mag" was a winner of the first prize in the puppy class at the New York Bench Show in 1880. She was also a winner of the second prize in the open class at New York in 1881.

IRISH SETTER, "RORY O' MORE."
Property of W. N. Callender, Greenbush, N. Y.



IRISH SETTER, "MEG."
Owned by Benj. F. Clark, Manchester, N. H.

**Points of the Irish Setter.**—The following description of points applies to the pure red variety, but the white and red differ from them only in color. It will be seen that although resembling the English Setter, in some respects, the Irish Setter differs very materially from them in others:

*The Skull.*—The skull is somewhat longer and narrower, the eyebrows being well raised, and the occipital prominence as marked as in the Pointer. *The Nose.*—The nose is a trifle longer, with good width, and square at the end: nostrils wide open, with the nose itself of a mahogany or very dark fleshy-color, not pink nor black. *Eyes, Ears, and Lips.*—The eyes should be a rich brown or mahogany color, well set, and full of intelligence; a pale or gooseberry eye is to be avoided. Ears long enough to reach within half an inch or an inch of the end of the nose, and, though more tapering than in the English dog, never coming to a point; they should be set low and close, but well back, and no approaching to Hound's in setting and leather. Whiskers red; lips deep, but not pendulous. *The Body.*—In frame the Irish dog is higher on the leg than either the English or Black-and-Tan, but his elbows are well let down nevertheless; his shoulders are long and sloping; brisket deep, but never wide; and his back ribs are somewhat shorter than those of his English brethren. Loin good, slightly arched, and well coupled to his hips, but not very wide; quarters slightly sloping, and flag set on rather low, straight, fine in bone, and beautifully carried. Breeders are, however, going for straight backs like that of Palmerston, with flags set on as high as in the English Setter. *The Legs.*—Legs very straight, with good hocks, well-bent stifles, and muscular but not heavy haunches. *The Feet.*—The feet are hare-like, and moderately hairy between the toes. *The Tail.*—The tail is clothed with a long, straight comb of hair, never bushy or curly, and this is beautifully displayed on the point. *The Coat.*—The coat should be somewhat coarser than that of the English Setter, being midway between that and the Black-and-Tan, wavy but not curly, and by no means long. Both hind and fore legs are well feathered, but not profusely, and the ears are furnished with feather to the same extent, with a slight wave, but no curl. *The Color.*—The color should be a rich blood red, without any trace of black on the ears or along the back; in many of the best strains, however, a pale color or an occasional tinge of black is shown. A little white on the neck, breast, or toes, is by no means objectionable, and there is no doubt that the preponderance of white, so as to constitute what is called "white and red," is met with in some good strains.

**Retrievers.**—There are various kinds of dogs used for retrieving in open or covert shooting. Retrievers proper, however, are cross-bred dogs, the principal of which are the English Retriever, which is a cross between the Irish Water Spaniel and the Newfoundland; another valuable strain as a cross between the former and the English Setter. Another variety known as the Chesapeake Bay Retriever, is represented by three different strains, viz.: the Red Winchester, a dog with long smooth hair, the Curly Retriever, having curly hair of a reddish-brown color, and the Otter breed, a short-haired, smooth-coated dog of a tawny brown color. The object of the cross is to produce a dog sufficiently strong to carry heavy game, such as rabbits and large birds; and having sufficient hardiness not to be affected by running in cold water. The English Retriever has generally a curly coat, and is black and tan in color.

The qualities which are essential in the regular Retriever have been given as follows: "Great delicacy of scent, and power of stopping (which latter is often not possessed by the Pointer); cleverness to follow out the windings of the wounded bird, which are frequently most intricate, and puzzle the intelligence as well as the nose to unravel them; love of approbation, to induce the dog to attend to the instructions of his master, and an amount of obedience which will be required to prevent his venturing to break out when game is before him. He should also have an excellent temper."

The following anecdote is related of an English Retriever belonging to Sir Charles Taylor, which shows the wonderful intelligence of the animal. It was the custom of Sir

Charles to occasionally on a morning send out this dog to see if the weather was suitable for gunning, saying to him: "Go out and see if it will do." The dog would go out, walk round the house, putting his nose up in the air for a few moments, and then come back to the house. If "it would do," he would jump up on his master's knees and spring about the room in the most lively manner. Sir Charles would then tell him to fetch Tom, the keeper. Off he would go, sometimes to the distance of about a mile, to fetch the keeper. He would scratch at the keeper's door, run towards the corner where the guns were kept, and by delighted barks tell Tom that he was wanted to go out shooting. And then they wonld both be soon ready for the day's sport. If, on the contrary, "it would not do," the dog would come in slowly, looking down on the carpet in a dejected way, throw himself at length upon the rug, and go to sleep.

CAN'T YOU TALK?

**The English Spaniel.**—This is an excellent water dog, being one of the best swimmers and divers in the canine family. In duck shooting he is exceedingly valuable, as he never refuses to go where he can find game. He is nervous and restless, and requires to be kept under good control when used as a Retriever. There are two varieties, one much smaller than the other.

**The Clumber Spaniel.**—This variety of the Spaniel family of dogs is much used in England for partridge shooting. He is intelligent, strong, and remains perfectly mute when on the scent, and for this reason is much valued for hunting such game as take wing at the slightest noise. This dog has a large head, wide and full, muzzle broad and square, ears long and covered with wavy hair, eyes large and expressive, large bones, great length of body, rather short legs, and bushy tail; hair long and wavy. The color is yellow and white, the white prevailing.

**The Irish Water Spaniel.**—There are two varieties of the Irish Water Spaniel. Those of Northern Ireland have a curly coat, generally of a liver color with more or less

white, so that white frequently predominates, short ears with but little feather on them or on the legs. The south country Irish Water Spaniel is uniformly of a pure liver color, with the whole coat consisting of short, crisp curls; ears long and well feathered, the distance from the point of one ear to the point of the other sometimes measuring two feet; the body is large and heavy; legs strong; tail not feathered and carried slightly down. These dogs are generally from twenty-one to twenty-two and a half inches in height. The head of the best specimens is crowned with a well defined top-knot that comes down to a peak on the forehead. Those from the South of Ireland are most prized, they being very intelligent and easily trained.

**The English Greyhound.**—The term hound, as formerly used, included all dogs of the chase, or those used in securing game, but as used at present, it denotes only dogs that follow game by scent or sight, such as the different varieties of the Greyhound, the Bloodhound, Staghound, Foxhound, Beagles, Terrier, etc. The Greyhound is noted for beauty and grace of form, and great speed, and for ages has been employed in the chase, having been a great favorite with the wealthy and higher classes from the earliest historic times. The Greyhound seems generally to lack the affection, sagacity, and courage possessed by some dogs, although numerous instances might be cited in individual cases in which they evinced these qualities in a remarkable degree.

The English Greyhound is generally conceded to be the finest of this breed of dogs, being beautiful in form, possessing great courage and a fair amount of intelligence. They are kept principally in this country for their beauty, fleetness, and for hunting hares, rabbits, and similar small game. The points of the Greyhound were given in the familiar doggerel rhyme published in 1496, by Wynkynde Warde, who was a printer and writer of that time. The lines show the comparison between this breed of that time, and the present:

Headed lyke a snake,
Neckyed lyke a drake,
Footed lyke a catte,
Tayled lyke a ratte,
Syded lyke a bream
And chyned like a beam.

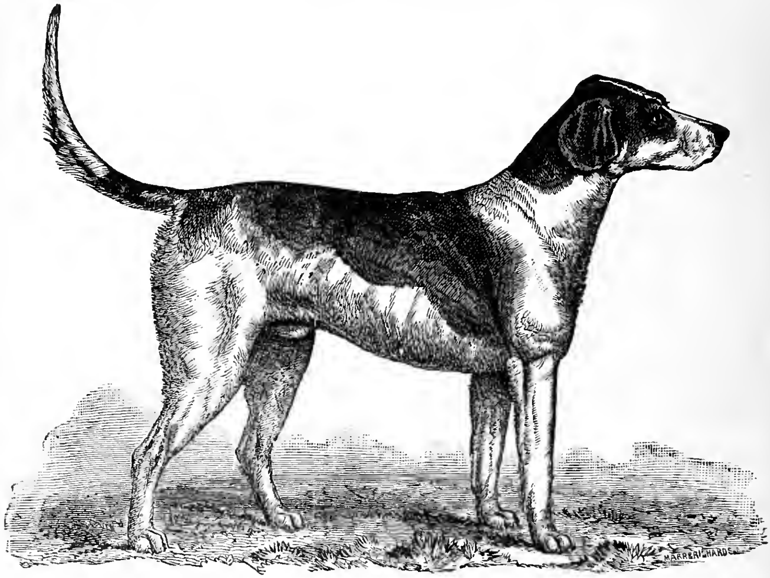
Of course all due allowance should be made for exaggerating the different points; for instance, every snake's head is flat and broad with the nose compressed, while the head of the Greyhound, though somewhat flat at the top, is comparatively circular in its transverse section, and the nose is triangular. "Sides like a bream, and back like a beam," we understand to mean great depth and breadth of chest, combined with a strong back. The foot resembles that of a cat in being round in form. The most fashionable colors at present are maltese or black, though very good specimens are seen of red, fawn, brindle, and white.

**The Deerhound, or Rough Scotch Greyhound.**—This is a noble and valuable animal, but at present rarely pure-bred. It is larger than the pure Greyhound, often attaining a height of twenty-eight inches, and weighing over eighty pounds. They have great speed and strength, and are used in deer hunting. They are always courageous, intelligent, and docile.

**The Foxhound.**—The modern Foxhound has been very carefully bred during the last two or three centuries, and consequently the breed has attained a high degree of perfection. It was produced by a cross between the old English hound and the Greyhound. They are noted for great power of scent, fleetness, courage, and endurance, and always cry out when on the scent, the tone of the dog usually indicating whether the scent is sure or not. Thus, if not quite sure, the note is given at intervals and undecidedly; but if sure, they run open-mouthed in full cry. A pack of hounds on the track of game, in full, united cry,

produce rare music for the true sportsman's ear. The Foxhound has been known to travel in the chase over four miles in seven minutes, while its endurance has been shown by the Duke of Richmond's hounds, that ran ten hours before killing the fox, during which time several of the sportsmen tired their horses. The following points of the Foxhound are condensed from the National (English) Dog Club Book:

The head should be light, indicative of great intelligence, and at the same time full of dignity, with a certain amount of chop, and the forehead a little wrinkled; the neck long and clean, with no approach to dewlap or cravat; the ears should be set low and lie close to the head; the shoulders long and well sloped back; the chest deep and wide; the elbows in a straight line with the body; the fore legs quite straight, large in bone, and well clothed with muscle; the pasterns or ankles must be large, strong, and straight, without turning in or out;



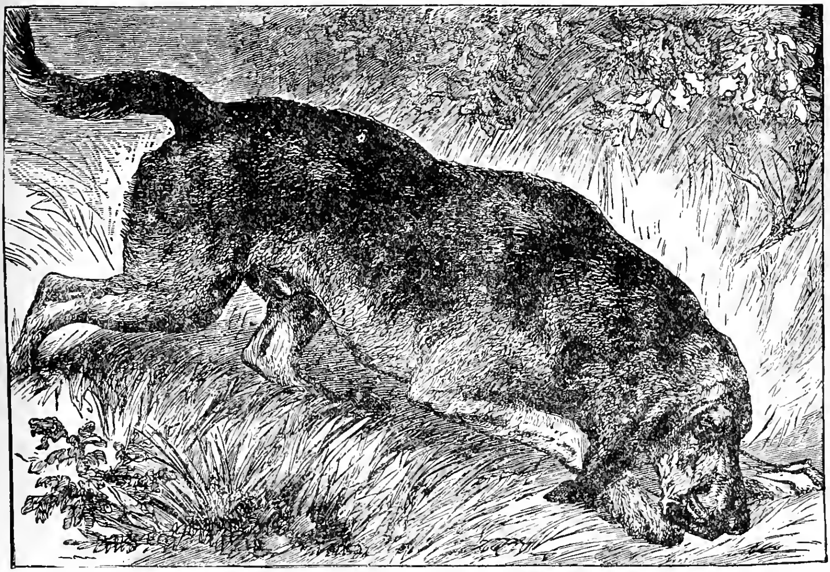
FOXHOUND "WATCHMAN."
Property of W. A. Van Brunt, Horicon, Wisconsin.

the feet round and rather flat than arched, the divisions between each toe being just apparent; the sole of the foot hard and indurated. The back should be straight, wide, and muscular; the loins strong and square; the hind quarters powerful, and the back ribs deep. The color usually preferred is black, white, and tan, the black and tan predominating. The coat should be smooth and glossy. The cut of "Watchman" is an excellent representative of the breed. This animal was imported from Sir Bache Cunard's kennel, England.

**The Bloodhound.**—This breed derives its name from its peculiar and extraordinary power of scent, they being able to follow any trail upon which they may be put, however intricate the track may be, or to what an extent it may have been crossed and recrossed by the tracks of others. The Bloodhound also possesses great courage, and is inclined to be ferocious, especially when kept much confined. Though frequently manifesting great

affection, gentleness, and faithfulness towards his master and friends, he can scarcely be considered a safe companion for man, and must ever be regarded with some degree of suspicion, a ferocious nature often suddenly and unexpectedly manifesting itself when least expected.

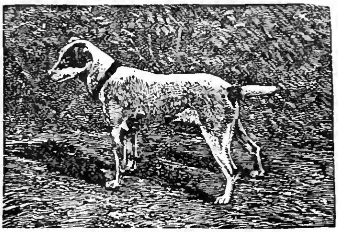
Pure specimens of this breed are rare, they having been frequently crossed with the Bulldog to render them more ferocious. In this country the Bloodhound is most common in the Southern States. The height ranges from twenty-four to thirty inches at the shoulder. In the best types of the English Bloodhound the head should be rather large, the forehead long and narrow; the eyes expansive, but deep and sunken, with the third eyelid, or what is called the *haw*, plainly visible, giving a peculiar redness to the eyes and imparting a fierce expression. The ears are very long, thin, and pendant, hanging straight down the sides of



BLOODHOUND.

the face; it is said that if they rise when the dog is excited, it shows that there is cross blood in the animal. The nose is large and black or dark in color, the face and upper jaw to the nose narrow; the lips (sometimes called flews) should be long, thin, and pendulous. The ears and flews of the perfect Bloodhound are long enough to touch each other when brought under the chin. The neck should be long and strong, the shoulders heavy and powerful, the feet large and compact. The back should be broad, the chest deep and full, and the tail carried in a graceful upward curve. His voice is deep, sonorous, and full, and when in pursuit the tone is kept up in a prolonged bay. The color is a reddish tan, darkening towards the head and back, or a black tan; no white should be seen, except perhaps on the tip of the tail. They are excellent aids in tracking criminals or large game, and except for this purpose are of but little use.

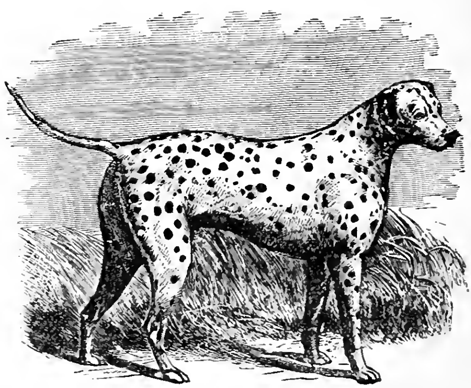
**The Fox Terrier.** — The principal use of this dog formerly was as a supplement to every pack of Foxhounds, for pulling foxes from their holes of refuge inaccessible to the larger dogs. At the present time, however, the hunting pace is too rapid for his fleetness, and he would be left considerably in the rear. He is, however, a very useful dog for general purposes about the farm, combining as he does many excellent qualities, he being a very good watch dog, ever on the alert for intruders, and one of the best dogs known for ridding the farm of foxes, skunks, woodchucks, minks, rats, etc., while he is very sagacious, courageous, and pleasant tempered. His weight is from sixteen to eighteen pounds. The head is narrow between the eyes, but widens between the ears; the ears are small and thin, lying close to the cheek, and are set well back on the head; eyes small, but intelligent in expression; jaws strong; chest full and round, but only of medium depth; neck rather light; back straight; tail short; limbs straight and strong. The color is white, with black or tan markings (sometimes both) about the head. The coat is fine, compact, and short.



FOX TERRIER.

**German Badger Hound, or Dachshund.** — This breed of dogs is exceedingly valuable for hunting the badger, raccoon, foxes, and similar animals. They are sure of scent, and although rather slow in pursuit are the most persistent of dogs, never giving up until they are forced to do so. They are affectionate, intelligent, cheerful in disposition, and possess great courage and independence of character. They resemble in some respects the hound, in others the terrier, although they are wholly unlike either. The head is large, chest deep and broad, body disproportionately long for its size, legs short and stout, bones heavy and strong, skin thick and elastic, hair short, wiry, and rather coarse. The usual colors are black with tan markings, brown with tawny markings, brownish red and gray with brown flecks. He is a homely animal, but hardy and useful, and when kept as a house pet makes an excellent watch dog, though apt to be snappish to strangers.

**The Dalmatian or Coach Dog.** — This is a well-formed, handsome dog, somewhat resembling the Pointer in shape. He is about twenty-five inches high, beautifully spotted with black on a white ground, the spots being about an inch in diameter, of nearly uniform size, and quite evenly distributed; they are also quite distinct from the white. These dogs are remarkably fond of horses, and of accompanying them on the road, and were formerly, in England, considered an ornamental appendage to accompany carriages; hence they derived the name of "Coach Dog." This custom has at



DALMATIAN OR COACH DOG.

present ceased to be fashionable. In his native country this dog is used to a certain extent as a Pointer in the field, and is said to perform this duty quite well.

**Black-and-Tan Terrier.** — Of all the pet and toy dogs, this is without doubt the most highly esteemed and attractive. They are remarkably active and intelligent little creatures, are very affectionate, and fond of being petted. These dogs are bred from the diminutive weight of three and a half pounds to fifteen or sixteen, five or six pounds weight being quite common. The small Italian Greyhound has been used in reducing the size of these dogs; they are therefore quite sensitive to the cold, and should be kept warm and comfortable in winter, being provided with the protection of a blanket when out of doors, and a bed and covering at night. These dogs are mainly black, the lower portions of the face, inside of the legs, and feet being tan; the lower part of the breast is also marked with tan, while directly over the inner corner of each eye is a distinct spot of tan nearly circular and about as large as a good-sized pea. The insides of the ears are also more or less marked with tan. In form they much resemble the small Italian Greyhound. We have one of these little dogs that weighs about seven pounds. He is one of the most intelligent animals we ever saw, seeming to understand distinctly all that is said to him, while he expresses his wishes very clearly by his dog talk and other ways of making himself understood. He is ever watchful of all intruders, and suspicious of strangers; but when he has once made up his mind that they are friends of his master and mistress, he treats them as friends. He is very jealous of the cat and other dogs that the mistress bestows any affection upon, and will seek to crowd or pull them aside, and beg to be caressed himself. He will walk all about the room on the tips of his hind toes, sneeze, shake hands, and "speak" when told, and sit up and sing if a person hums a tune for him, his singing being a kind of prolonged howl on a high key.

He is very courageous, and even impudent to larger dogs, always attacking them if they come upon the premises, and frequently inviting an attack from large dogs that generally trot off without seeming to notice him. These little creatures make excellent watch dogs in giving warning, as they are ever on the alert, and will bark excitedly at the least noise. Some one has well described this most intelligent and affectionate of pets in the following lines:

MY BLACK AND TAN.

I have a dainty playmate, dear
As is none other to me here
Of my own clan;
A brass-girt collar decks his throat,
And shines like silk his glossy coat
Of black and tan.

Companion of my lonely walks,
He trots beside me oft, he talks
As best he can;
Then, wild with sudden glee, will rush
And bark defiance at a thrush,
My black and tan.

Across his puzzled brain there throng
Confused ideas of right and wrong;
He has no plan
Of conduct for his daily guide.
The god he worships dwells inside
His black and tan.

You're very human, little friend;
I wonder if perchance you end
Where I began?
One faithful heart, I know, would ache
Were I with life for aye to break,
Ah! black and tan!

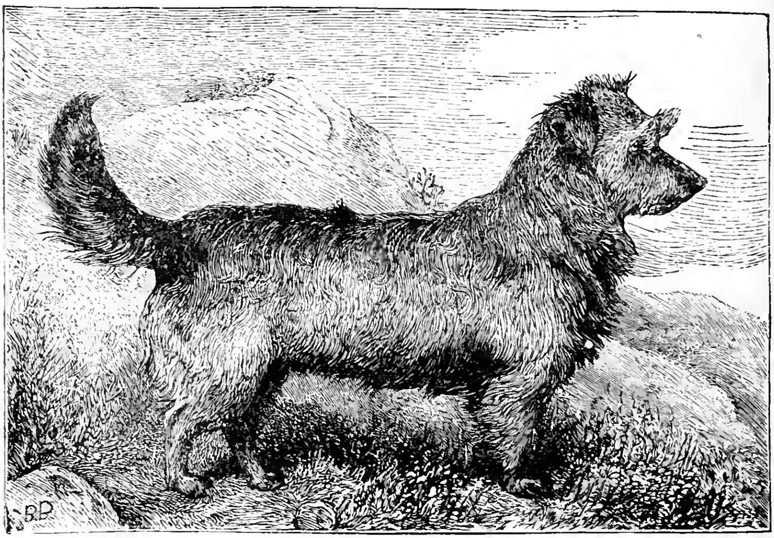
Maybe we're not so far apart;
Where is the point from which I start
To be a man?
Come, shake a paw, and let us think
If we can find the missing link,
My black and tan.

**The Scotch Terrier.** — There are many varieties of the Scotch Terrier, all of which are active, intelligent, very affectionate, and persistent hunters of rats, mice, and other vermin; in fact they will hunt anything from a fox to a mouse. The principal varieties of this breed of dogs are the Skye, the Rough-haired, Smooth-haired, and the Wire-haired or the Dandy Dinmonts, all differing more or less in size, form, and color.

**The Skye Terrier.**—The origin of the Skye Terrier is so remote as to be lost in antiquity; he certainly merits the claim to belong to one of the very first families of the canine race. There are two varieties of Skyes, known as the prick-eared and the drop-eared, and upon the manner in which they carry their ears much depends in judging of their respective points.

SCOTCH TERRIER.

In either case, the ears should be placed well up on the top of the head, the prick-ears standing boldly erect, and the drop-ears standing close to the side of the head. There is also the short-haired and long-haired variety. The first has hair of coarse quality, glossy — not woolly — slightly wavy, and covering a soft, thin waterproof undercoat that serves as a great protection to the skin. The long-haired or pet Skye has a much heavier and longer coat than the former, which is so compact and heavy that it is often compared to a mat. The grooming that these pet dogs receive adds much to the fine appearance of the coat, but the hair is always but slightly wavy, or nearly straight. The best Skyes carry their tails high. In color they may be brown, gray, silver gray, blue, black, and fawn, although the short-haired variety are mostly brown. A critical judge of this breed, in describing the long-haired variety, says:



SKYE TERRIER "FLORA,"
Bred by Gen. G. McDonald, Rosshire, N. B.

"It should have its ears, legs, and tail all merged in one mass, with the exception of the tip of the latter, and of the feet. In a well-coated specimen the eyes are only to be guessed at, and even the nose is often obscured; but generally they are each more or less visible on a

close inspection. The eyes are keen, expressive, small, and generally of dark color, either black or brown, as are the nose and palate. The ears are of good size, that is, about three inches long, clothed thickly with hair, which should mingle with that of the face and neck, and decidedly falling, but not quite close to the cheek, owing to the quantity of hair by which they are surrounded. The shape of the head is not easily got at, but it is somewhat wide, while the neck is unusually long. The body, also, is too much coated to show its shape, and the form of the shoulders and back ribs can only be ascertained by handling, or by dipping the dog in water, when the shape at once becomes apparent. The fore legs are sometimes more or less bandy, but the less the better; there are no dew claws, and the feet are not very strong, having a tendency to flatness and thinness of the soles. Tail long, and carried horizontally, but with a sweep, so that the tip is a little below the level of the back. Weight, from ten to eighteen pounds, the bitches being nearly as heavy as the dogs — perhaps about two pounds less. The colors most fancied are silver gray with black tips, fawn with dark brown tip to the ears and tail, dark slaty blue (slightly grizzled, but without any absolute admixture of white), black and pure fawn — the order we have named being in accordance with the value of each. The hair should be long, straight, and shining, like that of the tail of the horse; any appearance of silkiness, wooliness, or curl to be avoided, excepting on the top of the head, where it has a slight tendency to silkiness. By some fanciers the prick-ear is preferred to the drop, the strains in which this point is shown being stronger in the body, and hardier in constitution and courage. The prick-ear should stand up well, and terminate in a fine tuft of hair coming to a decided point."

There is probably no better Terrier for the destruction of small game and vermin than the short-haired variety, as they are sagacious, hardy, energetic, and courageous, and will plunge into the coldest water in pursuit of game, manifesting the greatest persistence in securing it. Aside from being a game dog, the Skye makes a most useful watch-dog for dwellings at night, always being on the alert to give the warning if there is anything going wrong. They are also very companionable and pleasant in disposition.

**The Yorkshire Terrier.** — This is another of the Scotch Terrier family. It has a compact, well-formed body covered with long, straight hair. The head is rather large for the body, and the nose sharp. The most desirable of these dogs have three different shades of color, blue, silver, and tan; the tan on the fluff of the head, ears, and legs being of a very rich shade. There is a variety known as the blue-tan Yorkshire, or silk-coated Terrier, which have a coat of a rich blue-tan color that is exceedingly long, silky, and smooth. This is supposed to be produced by a Maltese cross, and is a modern variety somewhat rare.

**The Maltese Terrier.** — This is a favorite toy dog, and is a complete mass of long, silky hair, the hair being so compact and long as to disguise the outline of the animal. Pure bred dogs of this breed are pure white in color, with a tendency in the hair to curl.

**The Italian Greyhound.** — These are probably the most elegant and delicate of house dogs. They resemble the English Greyhound in all respects except size, being a perfect miniature of that breed. It is bred in Italy and Spain in great perfection, the warmth of the climate agreeing with its constitution most admirably, as it is very sensitive to the cold. It is bred principally for a toy dog, although it will sometimes catch small game in warm weather. The size most preferred is when the weight is about six or eight pounds. They are deficient in courage, and so sensitive to the cold, that in a cold climate they must not only be well housed, but should be protected with a blanket when out of doors in cold weather. The colors most desired are fawn, blue, or black.

**The Poodle.** — This is an exceedingly interesting pet, it being very intelligent, and therefore admirably adapted to being taught a large number of tricks. For this reason, showmen who exhibit educated dogs, generally depend upon the Poodle for the performance of

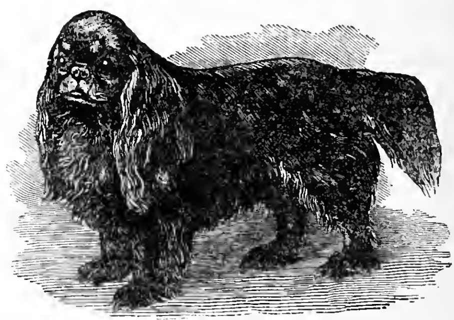
those tricks most intricate and difficult, and it is truly astonishing to what an extent they may be trained.

An English writer says: "With more intelligence than falls to the lot of any other dog, he unites great fidelity to his master, and a strong love of approbation, so that he may readily be induced to attempt any trick which is shown him, and the extent to which he may be taught to carry out the secret orders of his instructor is quite marvelous. He fetches and carries very readily, swims well, and has a good nose, but has no particular fondness for hunting game, often preferring a stick or a stone to a hare or pheasant. Two of these dogs which were exhibited in London astonished every one with their clever performances, sitting upon the table gravely, and playing a game at cards as quickly as a human being, the cards being placed before them, and the one to be played being selected by the dog's foot. Of course this was all done by preconcerted signal, but nevertheless it was remarkably well managed, and showed a wonderful degree of intelligence and discipline.

The Poodle is characterized by a large wide head, rising sharply at the forehead, long falling ears clothed with thick curly hair, rather small eyes, square muzzle, with a liberal allowance of jowl, and a sedate appearance until roused by any prospect of fun; a well-formed pointer-like body, but covered with thick closely curling hair, hanging down in ringlets below; tail usually cropped more or less, naturally covered with crisp curls; legs straight, and covered all round with hair hanging in short ringlets; feet small and round, and moderately hairy; color white or black, or white and black; height from sixteen to twenty inches."

Those pure white in color are generally preferred. We have seen these dogs so trained that two of them would stand erect upon their hind feet, and putting their fore paws upon each others' shoulders, would waltz about the room keeping time to music; also stand on their heads, balance themselves on the back of a chair, resting upon the head with the hind feet in the air, jump the rope, etc.

**The King Charles Spaniel.** — There are two recognized varieties of the Toy Spaniel, viz.: the Blenheim, and the King Charles Spaniel, which have a somewhat close resemblance, although the latter is the largest, and is considered the handsomer of the two, — if handsome they could be called. The points in the King Charles are: Head round and short; ears long and pendant, well coated, or what is termed "feathered;" eyes large and prominent; nose short with a deep stop — that is, well indented just at the setting in of the nose from the forehead; neck short, well coated; shoulders wide; fore legs short and well feathered; feet long, with good coat between each toe; back compact and short; loin strong; tail carried low, never higher than the level of the back, with plenty of feathers on it; hind legs well feathered also; coat abundant, silky, straight, and glossy; the black pure and very fine; where tanned, rich mahogany color, free from white, a tan spot over each eye, lips tan, and all under parts, with legs and feet, deep rich tan.



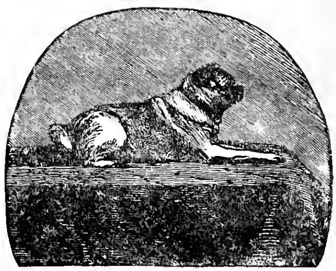
KING CHARLES SPANIEL.

The Blenheim varies but slightly from the former except in color, and being of smaller size, the color being always a white ground with red or yellow spots, and a well defined blaze

between the eyes. As a house dog they are watchful, and will bark at intruders, thus giving warning; they however possess but little courage, and do not follow well when out of doors.

**The Pug Dog.** — This dog is at present quite a favorite as a pet. It is said to be of Chinese origin, and has long been quite common in Holland, where they are much admired. He seems to bear the same relation to the Bull-dog that the Bantam does to the largest breed of fowls. The Pug is sensible, affectionate, and playful, and bears the confinement of the house better than most breeds. The points have been given by good authority, as follows:

General appearance low and thick-set, the legs being short, and the body as close to the ground as possible, but with an elegant outline; weight from six to ten pounds; color fawn, with black mask and vent. The clearer the fawn, and the more distinctly marked the black on the mask, which should extend to the eyes, the better; but there is generally a slightly darker line down the back. Some strains have the hair all over the body tipped with "smut," but on them the mask is sure to shade off too gently, without the clear line which is valued by the fancier: coat short, thick, and silky; head round, forehead high; nose short, but not turned up; and level-mouthed; ears, when cut, cropped quite close, naturally rather short but falling; neck of moderate length, stout, but not throaty; chest wide, deep, and round; tail short, and curled closely to the side, not standing up above the back. It is remarkable that the tail in the dog generally falls over the off side, while in the bitch it lies on the near. The legs are straight, with small bone, but well clothed with muscle; feet like the hare, not cat-footed; no dew-claws on the hind legs. The height is from eleven to fifteen inches.



PUG DOG.

**Breeding.**—The general principles of breeding adapted to the dog are similar to those of other domestic animals, which have been so fully discussed in a separate department of this work that nothing need be said in this connection, except what applies particularly to the canine race. The following special principles have been derived from the best English and American authorities on this subject: "The best age to breed from, in almost all breeds, is soon after the sire and dam have reached maturity. When, however, the produce is desired to be very small, the older both animals are, the more likely the result is, excepting in the last litter which the bitch has, for this being composed of only one or two puppies, they are not smaller than the average, and are sometimes even larger. All bitches should be allowed to reach fully maturity before they are permitted to breed, and this period varies according to size, small dogs being adult at one year, whereas large ones are still in their puppyhood at that time, and take fully twice as long to develop their proportions. The Mastiff is barely full grown at two years, large hounds at a year and a half, Greyhounds at the same time, Pointers and Setters from a year and a quarter to a year and a half, while Terriers and small toy dogs reach maturity at a year old, or even earlier.

The best time of the year for breeding dogs is from April to September, inasmuch as in the cold of winter the puppies are apt to become chilled, whereby their growth is stopped, and some disease very often developed. The toy dogs, and all small dogs which are reared in the house, may be bred at almost any time of the year; but even they are stronger and healthier if born in the summer months, because the puppies may then be supposed to get more air and sun than they could in the winter, when the warmth of the fire is essential to

their well-doing. Most female dogs will breed twice a year at regular periods under favorable circumstances, but individuals vary in this respect, the period of oestrum occurring in some every four or five months, in others every seven, eight, nine, ten, eleven, or twelve months; but with the larger proportion it occurs twice a year quite regularly. The time between the first and second periods will generally indicate the length of time intervening between succeeding ones.

During parturition do not meddle unless the time of birth be protracted considerably. When assistance is necessary, it should be done in the most careful and gentle manner, so as not to injure either the mother or offspring. Keep her warm and feed on light, easily digested food, such as soup, mush and milk, etc. She should be given some cooked meat every day while suckling her puppies. If her appetite fails at this period, she will be apt to become very weak and emaciated. If the teats or any part of the udder become sore or or swollen, bathe in warm water several times a day, and when dry rub well in the following lotion: one ounce of gum camphor well mixed with four ounces of olive oil. If the puppies should die, the inflammation of the udder should be kept down by milking the teats carefully two or three times a day. The puppies may be weaned at from five to six weeks of age.

**Period of Gestation.**—The reproductive power in dogs generally lasts eight or nine years; the number of offspring produced at a single birth varying with different breeds, but with most breeds averaging five or six, the average period of gestation being sixty days, the shortest period fifty-five days, and the longest sixty-four days.

**General Management of Dogs.**—Dogs should have good care and kind treatment in every respect. There are many persons owning a dog who, without intending to be at all cruel to the animal, but through lack of thought or on account of indifference, fail to give him that considerate and kind treatment that he should receive. Perhaps he is not provided with any shelter in cold, stormy weather, while the amount and quality of food is scarcely sufficient to keep him from starvation. When we add to this that he is frequently tied to a short chain most of the time, and never permitted to have the exercise that is essential to his health, and too often under such circumstances, has an insufficient supply of water, which is generally warm or otherwise unfit to drink, it is no wonder that the poor faithful animal either sickens or dies, or becomes morose and peevish.

In order to be healthy and useful, dogs should be well and regularly fed. A half-starved dog is not half a dog in any respect. Before being weaned it is well to commence feeding the puppy a little with milk that is slightly sweetened with sugar. When first weaned, he should be fed as many as four times a day with milk, or perhaps once or twice a day instead, milk gruel thickened with wheat flour or cornmeal, occasionally giving him small scraps of cooked meat, boiled potato, etc. When three or four months old he should be fed three times a day, changing his diet somewhat, but making oatmeal and cornmeal pudding from water in which coarse meat has been boiled, the principal food, allowing him the bones to gnaw and some of the meat. After he is six months old he may be fed with this, and table scraps, such as meat, potatoes, corn bread, biscuit, etc. Clean, fresh water should be within his reach at all times, and an abundant supply of it.

The house dog should be regularly cleaned. This he requires as much as a horse. A dog that is washed thoroughly at least once a week, using soap, will not be much troubled with fleas. Wash with soap and water, carefully rinsing out all of the soapy water from the coat. They should also be brushed once a day. The membranes of the toes sometimes get sore. When this occurs wash carefully with soap and water, and apply cosmaline. With good and suitable food regularly given, a plenty of clean, cool water, cleanliness, and a sufficient amount of exercise, a dog may not only be healthy and serviceable to his master, but be a happy animal as well, which is the only condition that will secure the best service from him.

**Exercise.**—The dog is naturally an active animal, and will suffer if not permitted to have a sufficient amount of exercise. The young dog must have exercise from necessity, while the old dog will soon become absolutely worthless without it. In fact we never knew a puppy that was kept confined that ever became a fine dog. The practice of keeping a dog chained most of the time is a cruel one, besides it will make the animal thus treated sullen, ferocious, and stupid, and about as worthless as a wild brute. When necessary for any purpose to keep a dog chained for a limited time, be humane about it and give him sufficient length of chain to admit of some liberty and exercise.

A recent writer recommends the following sensible method of securing this: "If want of space or the arrangement of the lawn, flower beds, and garden make it necessary to chain your dog, you can give him far more liberty than a common dog chain will allow, by a simple method, and still secure your dog within certain bounds. This device consists in planting two stout, short posts, one by the kennel and the other one from twenty-five to fifty feet from

LAYING DOWN THE LAW.

the first. Stretch a stout wire (old telegraph wire will answer the purpose nicely) from one post to the other and secure it firmly, first running it through the end of the dog chain. The dog will soon understand how to make use of this apology for liberty, and will frequently exercise himself 'up and down the line.' We advise all who keep a dog, and are obliged to keep him on the chain most of the time, to try the above plan, and the dog will thank you for the kindness in many ways. Give your dog daily attention, not merely enough to eat and at regular intervals, but give him fresh water daily, and change his 'run,' when necessary, so as to afford him an opportunity to have his run or exercise on the grass instead of the hard, compact soil."

**Dog Kennels.**—Dogs need shelter as well as human beings, and should always have it. It is true that nature has supplied most breeds of dogs with a warm covering, which affords

ample protection under most circumstances, yet at night and in cold or stormy weather they should be provided with shelter. They should have a well built dog-house, which is amply supplied with clean, dry straw for bedding, rye straw being the best for the purpose. This should be changed sufficiently often to keep the bed clean and comfortable. In making a dog-house make it large enough for comfort, perfectly rain-proof, and sufficiently tight for warmth, not forgetting to have ventilation so arranged that the air of the kennel can be kept pure without exposing the animal to a draft of air. There should be a broad floor, with cleats or blocks underneath to raise it from the damp ground, thus securing it from dampness, otherwise there will be a liability of the animal contracting rheumatism and other diseases to which canine flesh is subject. White pine is a cheap, light wood for building a dog kennel, and is also the most easily worked.

**Training Dogs.**—Dogs should be trained according to the purpose for which they are to be used, for without proper training a dog is comparatively of but little value. Obedience should be the first lesson in training, and this should commence early. When this has once been learned, the remaining part of the dog's education is merely the result of patience and practice. In order to secure prompt obedience, it is not necessary to practice severity, much less cruelty. The experience of the best trainers proves that the less one uses the whip, the better the dog. When a pleasant tempered, intelligent dog once understands what is wanted of him, he will generally be pleased to do it, if praised for his obedience and preference, with perhaps at first a reward with some choice bit that he prizes. When obstinate, which is very rarely the case, obedience must be secured by sterner measures, but we would not recommend punishment except in rare cases, such as those of willful disobedience.

Many otherwise valuable dogs have been rendered worthless by cruel and severe beating, often, perhaps, when they did not understand what it was for, and thus have had all the courage taken out of them. Kindness and praise will accomplish much more than blows and harsh words, and will have a tendency to improve upon all his desirable qualities, while severity and cruelty has, as a general result, the opposite tendency. In training to carry, take a small stick, and after handling it, let him smell it; then allow him to take it in his mouth; afterward throw it on the ground a short distance; and tell him to bring it to you. If he does so, pat him and give him words of praise, with a bit of something that he likes, or perhaps the praise will be a sufficient reward with some animals. Then throw it a little further off, and have him find and bring it to you, always allowing him to see you throw it.

In this way an intelligent dog can be very soon taught to carry game, and even live birds, without harming them. Dogs can be taught to perform any trick within their capacity, by kindness and patient effort, always rewarding them in some way, either by caresses, praise, or some choice bit, to show your appreciation. Mr. J. K. Felch states that a Collie puppy four months old was trained to carry a newspaper from the store to his master's house, going to the store and asking for it with a sharp bark; at one year old he would go from the factory to the house, or house to the factory, with a note, waiting an answer, and return. He would go to the store for the paper, and if told *"it is not here,"* would go to the owner's father for it before returning to the house, for the reason that some of the family sometimes went over to get it to read in the meantime. He would shut the door when told to do so, bring your cane, hat, slippers, gloves, or paper by sending him for them by name, all of which he learned without once being punished.

**Training Shepherd Dogs.**—The following directions for training shepherd dogs, given by Dr. N. H. Paaren, will be found of great value to those desiring such information: "Most men professing to train young Collies display much ignorance of the nature of the breed, and of the aptitude of the particular individual for its peculiar work; and hence many

dogs are made unfit for useful service. Every Collie pup has a natural instinct for work among sheep, nevertheless pups should be trained with an old dog. Their ardent temperament requires subduing, and there is no more effectual way of doing this than keeping them in company with an experienced dog. A long string attached to the pup's neck, in the hands of the shepherd, is often necessary to make it become acquainted with the language of the various evolutions connected with work.

With this contrivance he may learn to "Come in!" "Come in behind!" "Lie down!" "Be quiet!" "Speak to them!" "Get over the fence!" He will, if due patience and constancy is exercised, learn all these terms, and others, in a short time. The bitch is generally more acute in learning than the dog, and is not so apt to be lazy, though the dog will bear the greater fatigue. The quietly-disposed shepherd mostly prefers the bitch, and is chary of working her when in pup.

The best time to begin the training of a pup is about the sixth or eighth month of its age. When a year old or more, before his training is begun, he will never amount to much. The most sensible and easily trained pups are those which are got by pure-bred and well-bred parents, and from well-broke ancestors on both sides of the kennel. A Shepherd's dog takes as much pleasure in driving sheep as some curs do in following a wagon; and it is as natural for a Shepherd's dog to run back and forth behind a flock of sheep as it is for a setter to raise his forefoot at the sight of game; but beyond this they have to be taught. Before taking the young dog into the field, he should be perfectly familiar with you. He should know his name, and mind you when called upon. If he is not attentive, or does not come immediately, speak sharply to him, or lightly box his ears, but never jerk him by them; practice this until he will come at your bidding, even if he knows he is to get a flogging. Never punish the dog unless he knows why he gets punished. Do not whip him before you are satisfied whether he understands your order, or whether he disobeys from unwillingness.

All orders should be accompanied by a motion with the hand in the direction you wish him to go. If he does not come when called upon, or refuses to go in the direction you send him, continue to give the same order, and make the same motion until you can get up to him, and then punish him, if he deserves it. Never let him go without correction when he disobeys, and then, an hour after, when he has forgotten all about it, whip him because you have finally got hold of him, and are angry. In order to give your dog confidence in you, and make him attached and obedient, your conduct should be such as to make him think you a right good fellow. A few whippings may possibly be necessary with certain dogs in the course of training, but the whippings should be few and far between, and always with moderation, and with a feeling of due regard for humanity; otherwise your dog is apt to become dogged, morose, sullen, and a coward.

The rudiments of training of a Shepherd dog consist in bringing him to promenade back and forth from one side of the flock to the other at the motion of your hand. The next step will be to have him pass up the side of the flock — yourself and the dog supposed to be at the rear of the flock. Your dog is supposed to be conversant with the meaning of this motion of your hand and arm; so when you point forward with your left hand and arm, you must continue calling out the words, 'Away up!' until he gets hold of your meaning, and goes up along the left of the flock. Having nothing else to do, exercise your patience and improve your voice by a constant reiteration of your commands — always throwing your arm out, as you would in directing a man who was beyond the reach of your voice. Idleness is the progenitor of laziness and vice, wherefore, in order to prevent your pup from acquiring either of these habits, keep him constantly occupied, by putting in almost your entire time in making him do something, provided, of course, that you do not worry the flock or tire your dog too much. By degrees, the dog will be urged up towards the head of the flock, and partly

around. While there, change your position at the rear of the flock, towards the right — supposing you were at the left, and your dog had been sent upon along the left side — and call him down towards you along the right side, by making a motion towards you, and crying 'Come in!'

A sweep of the arm from the side you wish him to start to the other, is the proper motion, when you want him to go ahead and around them, and the motion should be accompanied with the cry 'Around them!' It requires some time and patience to bring the dog up and ahead of the flock. It will come by degrees; and if your pup is possessed of some good, hard dog sense, it will not take him long to know that 'Up! Away up!' means that he shall go for the head of the flock. Always call his name in giving any order, and always make the motion with your hand. If he does not quite understand your meaning, he will most probably stop on his way up and look around at you, to see what comes next, when you must repeat your motion, and cry, 'Up! Away up!' until he goes ahead.

If you are driving a flock along a fenced road, or in a field along a fence, and you want your dog to go ahead of them, get over the fence yourself, and motioning and calling the dog, 'Over and up!' he will mount the fence, when he fathoms your meaning, and go ahead inside the fence, or outside, as directed. If you want him to stay at a certain place, away from you, teach him to 'Stop there!' or 'Lie down!' If you wish to go ahead of your flock yourself, and have the dog remain behind, go ahead along one side; and if the dog wants to follow you, drive him back with threatening motions, and the words 'Go behind!' and when he has got back to place, keep an eye on him, and say occasionally 'Drive them up!' and 'Speak to them!' By practicing this a short time on a fenced road, the dog can be taught to bring the flock up after you, in whatever direction, even on a wide field.

It is not desirable to have the dog barking much of the time. You must teach him to 'Keep quiet!' and to 'Speak to them!' In order to make him speak to them whenever you wish him to, make a big fuss yourself, and so get him excited, when, by singing out 'Speak to them!' you can set him barking. This is especially desirable when he is bringing up the rear, when crossing a railroad, driving them over a stream, or into a yard. In training a dog, a shepherd must be careful in not letting him get the habit of crowding the sheep too much, whether they are on the move or are grazing in the field. Some Shepherd dogs acquire the habit of taking hold of the legs of the sheep, whereby the skin is apt to break, if the wool is not of some length. If the dog is trained to catch any sheep that is pointed out to him, he should be taught to take hold at the side of the neck near the shoulder, not at the ear, and least of all, at the throat.

In Texas, they have a way of training dogs with sheep. A pup is taken from its mother before its eyes are opened, and put with a ewe to suckle. After a few times the ewe becomes reconciled to the pup, which follows her like a lamb, grows up among, and remains with, the flock; and no wolf, man, or strange dog can come near the flock of sheep; and the flock will follow the dog to the fold regularly at half-past seven P. M., if you habitually feed him at that time.

It would be quite possible to cause the dog to perform all his duties by means of the motions of hand and arm alone, and without words, but the voice keeps up an understanding between the man and the dog, and helps to while away many a long hour. Too much use of the voice, however, is apt to make the dog unmindful and regardless of it. As to the names of dogs, they should be *short and emphatic*, not exceeding two syllables, for long names are difficult to pronounce when quick action is required.

Most young Shepherd dogs make a great noise, bustle about in an impatient manner, or run fiercely at the sheep, biting their ears and legs, and they generally overdo their work. Great harm may accrue to sheep by allowing the dog to work in these ways. Whenever sheep hear a dog bark that is accustomed to hound them every day, they will instantly start

from their grazing, gather together, and run to the farthest fence, and a good while will elapse before they will settle again. And even when sheep are gathered, a dog of high travel, and allowed to run out, will drive them hither and thither, without any apparent object. When a dog is allowed to run far out, it gets beyond the control of the shepherd; and such a style of working among wether sheep, puts them past their feeding for a time; with ewes it is very apt to cause abortion; and with lambs, after they are weaned, it is apt to overheat them, induce palpitation, and a considerable time will elapse before they recover their natural breathing."

A Shepherd dog should be taught to keep quiet unless ordered to bark, by saying "Speak to them!" and should be also trained to bark when thus directed. Barking is seldom necessary, except when penning sheep, when sometimes a quick, sharp bark will do more towards getting the leaders of the flock in, than continued barking would. Give him short and easy lessons, being sure that he thoroughly understands one before giving him another, otherwise he will become confused in his teaching. Always demand obedience to all calls, giving him daily lessons, and using invariably the same signs and calls, so that he will be able to understand them, giving him at all times kind and just treatment.

**Training Pointers and Setters.** — The methods adopted for training Pointers and Setters are identical. These dogs are very intelligent, and consequently quick to learn, if the trainer fully understands his business, and has sufficient patience and perseverance essential to success. Severity and cruelty are too often practiced by professional trainers, and for this reason it will usually be better for the owner to train his dog himself. Kindness and firmness are the best rules to abide by in training, remembering that in such cases as well as with the Collie, those dogs that are punished with the whip the least, are, as a general rule, the best; but if an animal is stubborn and willful, obedience must be enforced with the whip, but never with the ramrod or gun.

Always give the commands in the same language, otherwise they would not be understood. The words of command commonly used in the field, and which are consequently taught Pointers and Setters, are as follows: To avoid breaking over a fence or other barrier, "Ware fence;" to return from chasing hares, poultry, etc., "Ware chase;" to come and walk quietly behind the master, "To heel," or "Heel;" to run or course forward, "Hold up;" to lie down, "Down charge," or "Down;" to prevent taking food placed near, or to prevent running in on birds, "Toho." If the dog is not easily managed at first, being too full of spirits, it will be well to attach a light cord to his collar that is twenty or thirty feet long, and let it trail behind him; this will soon quiet him down. No puppy should be taken into the field until these orders are all fully understood, and promptly complied with in training. Field dogs should be well trained to the gun.

A good English authority says: "Punishment is not to be condemned altogether, for in some breeds and individuals without the whip nothing could be done; but it should be very cautiously applied, and the temper of each dog should be well studied in every case before it is adopted. Kindness will effect wonders, especially where united with firmness, and with a persevering determination to compel obedience somehow; but, if that 'how' can be effected without the whip, so much the better; still, if it cannot, the rod must not be spared, and, if used at all, it should be used efficaciously.

Shyness of the gun will generally also pass off in time; but, as it seldom occurs, except in very timid and nervous dogs, they do not often become very useful even when they have lost it. The best plan is to lead a shy dog quietly behind the shooters, and not to give him an opportunity of running off, which he generally does on the first discharge. When game falls, lead him up and let him mouth it; and thus, in course of time, he connects cause with effect, and loses that fear of the report, which he finds is followed by a result that gives him the pleasure of scenting fresh blood.

**Retrieving.** — Few Pointers and Setters will carry game far, nor indeed is it worth while to spend much time in teaching them to do so; and when they are set to retrieve, it is better to follow them, and help them in their search, so as to avoid all necessity for developing the 'fetch and carry' quality, which in the genuine retriever is so valuable. But it is chiefly for wounded hares or running pheasants that such a retriever is required; and as the former spoil a Pointer or Setter, and are sure to make him unsteady if he is allowed to hunt them, it is desirable to keep clear of the position altogether, while pheasants are so rarely killed to these dogs that their retrieval by them need not be considered.

The regular land retriever requires much more careful education, inasmuch as he is wanted to abstain from hunting, and from his own especial duties, except when ordered to commence. The breed generally used is the cross of the Newfoundland with the setter or water-spaniel, but, as I have explained in another place, other breeds are equally useful. In educating these dogs, they should be taken at a very early age, as it is almost impossible to insure perfect obedience at a later period. The disposition to "fetch and carry," which is the essence of retrieving, is very early developed in these dogs, and without it there is little chance of making a puppy perfect in his vocation. Young dogs of this breed will be seen carrying sticks about, and watching for their master to throw them, that they may fetch them to him.

This fondness for the amusement should be encouraged to a certain extent almost daily, but not so far as to tire and disgust the dog, and care should always be taken that he does not tear or bite the object which he has in charge. On no account should it be dragged from his mouth, but he should be ordered to drop it on the ground at the feet of his master, or to release it directly when it is laid hold of. The consequence of pulling anything out of the young retriever's mouth is that he becomes "hard bitten," as it is called; and, when he retrieves a wounded bird, he makes his teeth meet, and mangles it so much that it is utterly useless. A dog which is not naturally inclined to retrieve may be made so by encouraging him to pull at a handkerchief or a stick; but such animals very seldom turn out well in this line, and it is far better to put them to some other task. As soon as the puppy has learned to bring everything to his master when ordered, he may be taught to seek for trifling articles in long grass or other covert, such as bushes, etc.

When he succeeds in this, get some young rabbits which are hardly old enough to run, and hide one at a time at a little distance, after trailing it through the grass so as to imitate the natural progress of the animal when wounded. After putting the young retriever on the scent at the commencement of the "run," let him puzzle it out, until he finds the rabbit, and then make him bring it to his master without injuring it in the least. Encouragement should be given for success, and during the search the dog should have the notice of his master, by the words: "Seek!" "Seek!" A perseverance in this kind of practice will soon make the dog very bright in tracing out the concealed rabbits, and in process of time he may be entrusted with the task of retrieving a wounded partridge or pheasant in actual shooting. But it is always a long time before the retriever becomes perfect, practice being all important to him."

# DISEASES OF DOGS.

**Care of Sick Dogs.**—Sick dogs, like sick people, should have kind and considerate care. They should be kept warm, quiet, away from all noise and harsh words, and their kennels kept clean and well ventilated. Dr. A. J. Sewell, member of the Royal College of Veterinary Surgeons, gives the subjoined directions for nursing sick dogs: The successful treatment of our canine friends in severe cases of illness is one of those subjects which are too often neglected. And yet, if dog owners truly value the lives of their dumb companions, every possible care should be taken of them. The diseases which affect the dog are numerous, and it is not only in cases of dangerous and severe diseases that treatment is necessary, but also in cases of skin diseases. In these complaints much depends on the daily food supplied to affected animals, if we are to insure a successful and speedy termination of the affection. However scientific and proper the doctoring may be, if it is not aided by good and careful nursing, the veterinary surgeon's skill is all lost.

A person requires a large amount of patience to be a good nurse, for a harsh word to a dog badly affected with distemper will sometimes induce fits, and these, once established, more often than not prove fatal. It is my purpose to draw attention to the general management of sick dogs, and then direct special attention to the nursing of dogs affected with specific diseases, such as distemper, jaundice, etc.

I have been frequently requested to visit dogs affected with distemper, and on arrival, have found the patient chained to a kennel containing no straw or other litter, and in a yard paved with stones. With such treatment, dogs are often the subject of inflammation of the lungs, the result of exposure, besides being affected with distemper. When a dog is noticed to be ill, it should (if with other dogs) be removed to a room or kennel-house where it will be alone. He may not only affect others, but they will annoy and tease him, and so interfere with the patient making progress. The hospital should be warm (not hot) and well ventilated, free from all draughts, and the thermometer be kept as near as possible at 55° Fahrenheit. A basket or box should be supplied for the dog to lie in. The bottom should be covered with straw or hay—the former is best, as dogs lying on hay for any length of time, as a rule, become infested with fleas. Besides, as straw is cheaper, it may be changed daily, which is essential, as it adds to the comfort and cleanliness of the patient.

A large dish or pot of cold water should be placed within easy reach of the dog, and ought to be changed twice a day to insure its being fresh and cold. There are some cases where cold water is injurious, but these are rare. All evacuations from the patient should be immediately removed, and a little disinfectant fluid sprinkled about. The sick dog should be kept quiet, and by no means exercised. I have often witnessed a fatal relapse in distemper, the result of a few minutes' exercise. I have known persons—when a dog has had a prolonged attack of illness, and become rather offensive—put him in a bath, and wash. On no account should this be done, as it is most dangerous, more especially in the case of long-coated dogs, as these are very difficult to dry thoroughly. If left at all damp, the animals are liable to become chilled, and the disease is aggravated.

A dog, when very ill—say from distemper—should not even be brushed or groomed, as it excites and disturbs him, and increases the weakness, which is always great in this disease.

**Administering Medicine to Dogs.**—To have their proper and desired effects, medicines should be given regularly, and at stated times, and not as some persons do, to give a double dose because they forgot one. I have known this to be done repeatedly, and wish to warn owners of its fatal consequences. The medicine should be given quietly, and without disturbing the dog, if possible. One person, as a rule, is sufficient to give it if a little tact is

manifested. If it be liquid medicine, it is best given out of a small vial, one which will hold about an ounce. In administering medicine the person should stand in front of the dog, and with the left hand the muzzle of the animal should be held, the head slightly elevated, and the teeth kept nearly closed. The bottle containing the potion should be held in the right hand, and the neck of it placed within the lips on the left side of the face, between the teeth and cheek. Then small quantities should be poured into the mouth, and on no account should a second quantity be given until the first has been swallowed. Some dogs are rather obstinate in taking medicine, and hold it in the mouth some seconds before swallowing. Under these circumstances many people pinch the throat, with the idea of inducing the dog to swallow.

This act is dangerous, as it often makes the patient cough, and, with the fluid in the throat, sometimes choke from drawing it into the windpipe. All that is necessary, in most cases, is a little patience to keep the dog's head elevated, and he will soon swallow. In very obstinate cases the end of the nose may be pinched, which soon compels the dog to perform the act of deglutition. To give a pill or bolus, the upper part of the muzzle should be grasped, and the lips pressed between the teeth. This forces the mouth open, and it remains so, because the dog is afraid of biting himself. The head should then be elevated, and the pill or bolus dropped into the back of the mouth. The mouth must then be immediately closed and held until the dog has swallowed."

**Abscesses and Tumors.**—These occasionally occur in dogs that are weakly, and whose constitutions have been debilitated by disease, or from an impure condition of the blood. They generally come around the jaws and throat, and afterwards come to a head and break, discharging a watery pus. They may be hastened in coming to a head by poulticing; when soft, they may be opened, after which they will run for a few days before healing. After opening, inject two or three times a day a lotion of two drachms of carbolic acid, mixed with one pint of water. If the dog is in a debilitated condition, give every morning and night for a few days the following powder: two grains of sulphate of iron and three grains saltpetre. Keep clean, cold water in his kennel, where he can have constant access to it, and give a variety of food.

**Chorea.**—This is a nervous disease quite common to dogs, and is occasionally accompanied by fits. It is characterized by a quick, nervous jerking of any portion of the body, generally the head, neck, and fore parts, it sometimes being located in one leg or shoulder, and sometimes the entire body. In the latter case the dog is generally utterly useless. This disease frequently follows the distemper. A tonic given when a dog has been debilitated by any disease will usually prevent it; but when once fully developed, it is incurable. It is sometimes caused by worms, and when this is suspected to be the case, give simple worm remedies for their removal. Beyond this the general health must be improved. The following is a good tonic, which may frequently be found of valuable service: Sulphate of zinc, three grains; extract of gentian, two grains; mix and give as a pill night and morning. Careful attention should be given to the state of the bowels, an unnatural looseness or constipated condition being alike injurious.

**Constipation.**—Although not exactly a disease, yet a constipated condition of the bowels often leads to disease, or is the direct result of it. This difficulty is quite common with dogs, being frequently caused by too much meat diet, with too little exercise. An injection of lukewarm water will sometimes remedy the evil; but if this is not effected, give castor oil. For a large dog a half ounce of the oil will be necessary, to be repeated in about ten hours if the first does not have the desired effect. For small dogs the dose should be lessened accordingly. If the case be an obstinate one, increase the dose. It is also well to use the injection in connection with the dose. Feed on a mixed diet, such as table scraps, mush

and milk, oatmeal and cornmeal pudding, vegetables, soup, etc. Instead of continually dosing a dog for this difficulty, add oatmeal and corn mush to his diet, together with vegetables; boiled liver, cooked rather rare, is also good for dogs under such circumstances, fed two or three times a week.

**Diarrhœa and Dysentery.** — Unless judiciously checked, diarrhœa will be apt to run into dysentery. The latter may be distinguished from the former by blood being mixed with the excretions, great straining, pain, dejected countenance, and redness of the rectum. To regulate the bowels, give a mild dose of castor oil, giving as a diet mutton soup, wheat bread and boiled milk, or boiled milk thickened with cracker, rice, oatmeal, etc., avoiding corn meal mush, which is loosening to the bowels. Where the symptoms are those of dysentery, to a medium-sized dog give a tablespoonful of the following mixture: Castor oil, 3 ounces; laudanum, 2 ounces; tincture of ginger, 2 drachms, with frequent injections of warm water. The animal should be kept perfectly quiet, and fed on rice water thickened with arrowroot, scalded milk, mutton broth, and oatmeal gruel.

**Distemper.** — This disease often proves fatal to dogs, and requires judicious management. It is generally supposed that it is similar to the typhoid fever in man, and is the result of blood poisoning, the germ of the disease being admitted from without, or developed within the blood, by which means the secretions of the body are either checked entirely, or so changed as to no longer purify the system. The symptoms are languor, loss of appetite, redness of the eyes, nose hot and dry, urine high colored, pulse feverish, breathing rapid, shivering of the body. The bowels will sometimes be constipated and sometimes loose, the discharge being of a fetid nature. About two days after the attack the eyes and nose begin to have a watery discharge, a cough sets in, and there are symptoms of pneumonia; the tongue becomes coated, and there is a high fever, frequently accompanied with delirium and great weakness. The nostrils sometimes become so filled with a discharge as to prevent breathing through the nose, and the eyes so sore as to cause a partial blindness. When the seat of the disease is in the bowels, a violent diarrhœa is the result, which frequently proves fatal; when the brain is much affected, fits will generally be the result. Sometimes the skin is affected; in such cases pustules will appear on the inside of the thighs, fore legs, and on the belly. Dr. Sewell recommends the following treatment for distemper:

"The rules for the general management of sick dogs must here be observed, and then attention may be directed to diet. The first week the diet should be entirely of a fluid nature, as weak mutton broth or beef tea; and, if these are refused, milk may be offered. After the first week, when the dog is very weak, bread or biscuit may be added to the broth or other liquid food, which may now be given stronger. At this period of the disease the dog often refuses all nourishment. On those occasions it should be drenched with it — that is, given it out of a bottle as in medicine. The beef tea, if the dog is very weak, should be thickened with arrowroot, and a small quantity of port wine added. A fresh egg, well beaten up with a little brandy, may be given occasionally for a change. The food should be offered in small quantities every two hours. About the end of the third week, if the dog is progressing favorably, and the fever diminished, the diet may be increased. In addition to the beef tea and broth, small quantities of meat, such as mutton or beef (the former preferred), may be allowed. It is more serviceable when rather under-cooked. Should this cooked food be refused, raw meat is readily snatched up by some animals. Sheep's paunches, well cleansed and boiled, are frequently relished by a dog at this period, and may be given with safety, as they are easily digested. Large quantities of any kind of food should not be offered at a time, but rather small quantities every three or four hours. The quantities may be gradually increased as the patient improves and gains strength.

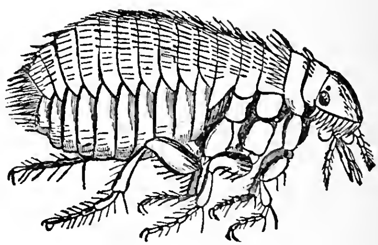
Distemper is often accompanied with a bad form of diarrhœa, which, if not stopped, quickly proves fatal. A judicious diet greatly assists in stopping the purging. If beef tea is

given, it should be thickened with gelatine; or, if milk, it ought to be first boiled, but not given until cold. The meat of boiled rabbit is a capital thing for dogs suffering from diarrhœa during this complaint; and biscuits made of arrowroot, of which dogs are very fond, will be found exceedingly useful. I do not think it out of place to again remind dog owners that in this disease great attention should be paid to ventilation, and other sanitary arrangements of the kennel."

When the lungs are affected, apply a mustard paste directly over the lungs, putting on a blanket to confine it in place.

**Fevers.** — (See DISTEMPER.)

**Fits.** — These are quite common to the canine race, and arise from different causes. They are divided into three classes, viz.: Convulsion fits, or those arising from irritation; those of the nature of apoplexy, accompanied with a pressure of blood upon the brain; and those of an epileptic nature. The first are common to puppies, and are generally produced by the irritation caused by teeth-cutting, which occurs in two periods, which are during the first month, and from the fifth to the seventh month. They usually come suddenly, the puppy lying on its side, the body being more or less convulsed. There will be no foaming at the mouth, it in this respect differing from epilepsy. The recovery is gradual. The best treatment recommended is a warm bath, followed by rubbing with a dry cloth, afterwards keeping the animal warm. In apoplectic fits the dog lies insensible, or nearly so, does not foam at the mouth, but breathes heavily and snores. Bleed slightly from the neck vein, afterwards purging with castor oil. Sometimes a seton is inserted in the back of the neck, but the attack is generally fatal. Sometimes these fits are caused by worms; in such cases, remove the worms, and the fits will cease. Epilepsy is characterized by blueness of the lips and gums, and by champing of the jaw and frothing of the mouth. These may occur at any period of the animal's life. The fit comes on suddenly, without any warning, and is common in sporting dogs, especially when at work on a hot day. Give the animal a full dose of castor oil; after half an hour give a tablespoonful of the following every two hours until the oil operates: Two drachms bromide of potash, mixed with six ounces of water. When worms are the cause, the treatment should be given at once for these.



DOG AND CAT FLEA, MAGNIFIED.

**Fleas.** — Dogs and cats are greatly worried by these troublesome parasites. They can, however, be very easily removed. Dust Persian insect powder, or pyrethrum, down into the roots of the hair to the skin; also under the fore legs, and the under side of the body. The same should also be dusted over the carpets, and about the floor and bedding of the dog kennel. Another method is to make an ointment of one ounce of oil of anise, well mixed with ten ounces of olive oil. Rub it well over the entire body, and allow it to remain five or six hours, after which wash thoroughly with soap and water, and rinse with clean water.

**Fractures.** — When the bones of a dog become broken, set them straight as carefully as possible; wrap in a soft flannel bandage or thin cotton batting, and apply light splints, somewhat pliable, one in front, back, and on either side; then wrap in starched bandages sufficiently light to keep the splints in place, but not too tight to prevent circulation. Wet the blankets thoroughly with a solution of tincture of arnica and water. Leave the splints on about four weeks, which will give the bones time to knit together.

**Goitre.**—This disease is an enlargement of a gland situated on the side of the neck, called the thyroid gland. It sometimes swells to such an extent as, by pressing upon the windpipe, to interfere with the breathing. Sometimes the glands on both sides of the neck become involved. Paint once a day with the tincture of iodine, or, instead, rub once a day with the following ointment, viz.: Two drachms iodide of potash, two ounces of lard, well mixed. By daily applications of either remedies, the swelling will usually disappear in four or five weeks.

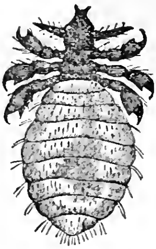
**Hydrophobia, Rabies, or Madness.**—Some writers consider this disease in the dog as consisting of two varieties or phases, viz.: The dumb, and the furious rabies, according as the animal is silent and undemonstrative when suffering from it, or noisy and ferocious. Hydrophobia is generally first manifested by uneasiness, restlessness, and irritability of temper; the dog that was formerly fond of being petted and pleasant in disposition becoming surly and shy, retreating to secluded places, like a dark corner of the room, under furniture, or the farther part of his kennel by himself, which he will soon leave for another equally secluded place. The appetite becomes depraved; the countenance shows an anxious, appealing expression, and sometimes very ferocious. The animal snaps at imaginary objects, or bites anything that comes in his way, even the boards of his kennel. In the early stages there is frothing at the mouth, which, however, soon becomes thick and glutinous as it lessens in quantity; there is also a twitching of the muscles of the face. Fever is always present to a greater or less extent. This disease is generally characterized by a dread of water, and sometimes by extreme thirst. After a time the gait becomes unsteady and tottering, and finally paralysis ensues, first of the hind quarters, and then of the whole body, when death finally gives relief. The duration of this disease rarely exceeds ten days, and sometimes death ensues in forty-eight hours. As to the length of time elapsing between the bite from a rabid animal and the development of the disease, nothing definite has been determined, it sometimes being several months, and often but a week or ten days.

No effectual remedy has yet been discovered, and when the symptoms of the animal indicate the disease it will be well to take the precaution of confining the animal where he can have comfortable care, yet will not be able to harm anyone. Fits should not, however, be mistaken for hydrophobia, and a valuable animal be thus unnecessarily killed.

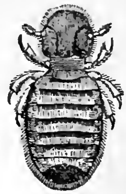
**Inflammation of the Bowels.**—This may be produced from various causes, such as eating food that would cause irritation of the stomach and bowels, such as acrid, caustic substances, constipation; also from poisons, lying on the cold ground, etc. The symptoms are those similar to other animals affected with it, such as great pain, uneasiness, fever, and soreness in the bowels. The dog will whine and manifest great uneasiness, frequently getting up and lying down, rapid pulse, high fever, rapid breathing, constipation, and soreness manifested in the bowels by slight pressure upon the sides. Give a full dose of castor oil with a tablespoonful of olive oil in it; also warm water injections frequently, until the bowels move. Apply to the bowels cloths wet in warm water, in which a tablespoonful of mustard has been dissolved. This will draw the blood to the surface of the body, and reduce the internal inflammation. Good nursing will prove more effectual than nostrums. Give light food, such as mutton broth, oatmeal gruel, milk, etc.

**Jaundice.**—This is sometimes called the "Yellows," and is characterized by a yellow tinge to the white of the eyes and skin, loss of appetite, a dry, hot nose, and a feverish condition of the body generally. If he refuses food, do not urge it upon him, except it be a little beef tea, or weak meat broth of some kind, or milk and water, to which may be added a small quantity of lime water. Place them within reach of the patient, where he can help himself whenever he desires. Plenty of fresh, cold water should also be kept near him, as he is generally feverish, and will consequently be thirsty. A dog with this disease should be brought back to his usual diet gradually, or a relapse of the symptoms will occur.

**Lice.**—There are two kinds of lice that live upon the dog, viz.: the blood-sucker (*oemetopinus*) which has a narrow, long head, and a strong sucking tube, and the bird louse (*trichodectes*). The latter has a large, broad head, and strong biting jaws, but differs from the latter in having no sucking tube. These parasites may be exterminated by sifting pyrethrum powder into the hair, or by the use of a wash of tobacco tea. The application of oil, as recommended for fleas, is also excellent for this purpose.



THE BLOOD SUCKER.



THE BIRD LOUSE.

**Mange.**—This disease is caused by an insect that burrows in the skin, causing intense itching. The animal will scratch so constantly that bare patches will be worn off his coat. This itching generally makes its first appearance around the eyes, on the elbows, fore legs, on the flanks, and down the inside of the thighs, soon after spreading all over the body. The eruptions produced are reddish with scaly patches between the pimples, and loss of hair. Mange is contagious, but ill-fed dogs with filthy surroundings are more apt to have it than others. Wash the animal thoroughly with soap and water to remove all the scurf and scabs; when the coat is well dried rub thoroughly into all the parts affected an ointment made of equal quantities of sulphur and lard well mixed. Apply daily, washing the coat thoroughly after the fourth day. In obstinate cases the treatment may have to be extended for several days. Give the animal good wholesome food and plenty of pure cold water.

**Paralysis.**—This disease frequently follows distemper, but may result from a bad cold, worms, or from some injury to the spine. It will, however, usually yield to judicious treatment. The symptoms are a staggering gait in the hind quarters, which sometimes results in the dog losing all power over them, and will drag the body around by the fore parts. Clip off the hair over the loins and apply to the back, along the spine, a mustard paste until it creates considerable irritation of the skin. Make twenty pills of the following: One-half drachm of powdered nux vomica, one drachm gentian, one drachm iodide of potash. Give a quarter of a pill morning and night for three days; then increase to half a pill for three days more; then to three-quarters of a pill for three days, and finally to a whole pill. Continue this treatment until a rigidity of muscles and stiffness of the legs are noticed from half an hour to an hour after taking the pill. These symptoms prove that the medicine has had the desired effect, and when they appear the pill should be stopped. In large or old dogs, the dose is sometimes gradually increased to two pills, but it would be too large a dose for a small or young dog, and would kill any dog unless increased gradually as previously described. In giving a large dose great care should be taken not to omit a dose, for in such a case the following dose might kill the animal, since it is a powerful poison. Keep the animal clean, and the bowels open with an occasional dose of castor oil. Feed a light, nourishing diet, and while recovering, be careful not to let him exercise much, as over-exertion might bring on the disease again. Rub the hind quarters and legs several times a day, with the hands.

**Poisons.**—The first thing to be done when a dog has been poisoned is to give an emetic, which may consist of a teaspoonful of mustard in a tumbler full of luke-warm water. If this does not vomit the animal, in a moment or two repeat it. A few raw eggs or a little milk should be given after the emetic has taken effect, as they moderate the action of the poison that may still be retained on the stomach and bowels. Give shortly after a full dose

of castor oil to free the bowels. A dog of an average size requires about the same dose of every kind of medicine as an adult man.

**Ring Worm.**—This is a local irritation, usually characterized by an elevation of the skin in the form of a ring, which spreads, the ring still retaining its form. The skin of the affected part becomes scaly and rough, the hair finally dropping off. The disease is caused by a parasite, and produces intense itching of the parts affected. Wash well with soap and water, and apply a lotion, consisting of ten grains nitrate of silver and one ounce of water. Mix thoroughly, and apply twice a day with a camel's hair brush.

**Surfeit.**—Dogs that are highly fed and kept in too close confinement, are apt to suffer from a surplus of flesh, fits, vertigo, dropsical tendencies, etc. The best treatment is to avoid the cause, by gradually reducing the feed, and increasing the exercise. If the bowels are constipated give mild doses of castor oil, with injections of warm water, until the difficulty is removed.

**Tetanus or Lockjaw.**—This is very unusual in dogs, and when it occurs is very apt to prove fatal. Remedies are of little avail.

**Worms.**—These are a fruitful source of disease in the dog, and infest those of all ages, from the puppy to the old dog. There are numerous varieties, all of which are propagated by ova; some are, however, viviparous, and the medicine that may clear the system of them at one period may not result in a permanent cure, since the eggs that remain in the stomach and bowels may afterwards hatch. Besides the intestinal worms of different varieties, there are others, such as the large kidney worm, the hydatid, and the *Toenia coenurus*, sometimes found in the brains of herbivorous animals.

*The Tape Worm* is a flat-bodied worm made up of segments or joints from one-eighth to half an inch in length. These segments are joined end to end, forming a worm that may be from one inch to a hundred or more feet in length. Its head is furnished with circular sucking discs, surrounded by one or more rows of hooklets by which it attaches itself to the internal coat of the stomach and bowels. As fast as these segments of the worm mature, they detach one by one from the tail end of the worm, and are expelled from the body in the excrement. They then crawl about on the ground and grass laying their eggs, and are liable to be eaten by other animals, as has been previously described in connection with Swine. There are at least five different kinds of the Tape Worm in the dog, all differing more or less from each other, yet similar in many respects.

*Round Worm.*—The Round Worm (*Ascaris marginata*) is quite common with dogs, and often does serious injury when existing in large numbers. They are generally from two to seven inches in length, round, firm, and pinkish in color. The two extremities are precisely alike, and are slightly flattened in one direction at the point. They frequently collect in bunches in the bowels as large as a good sized egg; sometimes also crawling into the stomach. They are propagated by ova, but are sometimes hatched in the body of the parent, and a large worm will accordingly be occasionally seen full of small ones. The Round worm of the cat (*Ascaris mystax*) is quite similar, and is common to the human species.

*The Maw Worm.*—This worm is larger in the dog than in the human species, where it is a mere thread, and is called the "thread worm." In the dog it attains an inch in length, being of a milky white color.

*Kidney Worm.*—This worm (*Estrougylus gigar*) is found in the kidney of the horse, ox, hog, dog, wolf, otter, raccoon, and other animals. Owing to the nature of its food, which is derived from the vessels of the kidney, it is of a dark blood color.

Professor Owens, an English authority, says: "When suppuration has taken place round

it, the worm has been found of a whitish hue. In the human kidney it has been known to attain the length of three feet, with a diameter of half an inch. The head is obtuse, the mouth orbicular and surrounded by six hemispherical papillæ; the body is slightly impressed with a circular striæ, and with two longitudinal impressions." *Worms of the Heart.*—The *Filaria imitis* is a very small worm occasionally found in the heart, and are apt to cause sudden death.

**Symptoms and Treatment.**—The general symptoms of worms are an unhealthy appearance of the coat, which will look dead, and staring; a ravenous appetite; loss of flesh; dry cough, with a desire to vomit; irregular action of the bowels, sometimes being attended with diarrhœa, and sometimes constipation; nose hot and dry, and breath offensive. If the animal is much reduced fits are apt to follow, frequently causing death. The Kidney Worm causes bloody urine, more or less mixed with pus. The Maw Worm is less injurious than any other kind. When Tape Worms are suspected, let the dog go without food (giving plenty of water), for twenty-four hours; then give him a drachm of areca nut powdered and made into a pill with syrup; four or five hours afterwards, give a full dose of castor oil. When the latter has operated, give twenty drops of the oil of the male shield fern mixed with one tablespoonful of olive oil. These doses are for large mature dogs; for young or small dogs give proportionately less. Examine the excretion to see what kind of worms are passed, or if the head of the Tape Worm is removed, and treat accordingly. If the head of the Tape Worm is not removed repeat the treatment in two weeks. For Round Worms, give on an empty stomach every morning for a week from twenty to thirty drops of turpentine in a tablespoonful of castor or olive oil. Another remedy is the following powder, given every morning for a week before eating: 3 grains santonine; 1½ grains sulphuret of iron; 15 grains of sugar of milk. This constitutes a single dose for a large, mature dog. After the last dose give two tablespoonfuls of castor oil mixed with fifteen drops of turpentine. At the end of three weeks repeat the treatment.

For worms in the kidney and heart, a leading English authority says: "Spirits of turpentine is without doubt the most efficacious of all worm medicines; but, if not given with care, is apt to upset the health of the dog, by irritating the mucous membrane of the alimentary canal, and of the kidneys also. I am satisfied, however, that it is not necessary to give it in its undiluted form, and that by mixing it with oil, its dangerous qualities are altogether suppressed. I have known young puppies, under two months of age, cleared of worms without the slightest injury, by giving them from three to ten drops, according to their size, in a teaspoonful of oil."

**Wounds.**—When a dog has been badly bitten, sew up the wound carefully, and bathe several times a day with a solution of equal parts of pure cider brandy, and water. This reduces the soreness and keeps out inflammation. When the feet of dogs get sore from punctures by thorns, exposure to cold water, etc., examine the feet carefully and remove the foreign body, if there be any, then bathe for some time in warm water, and apply a poultice of flax seed, or bread and milk, until the inflammation is gone; afterward bathe twice a day with the following lotion: one ounce of sugar of lead, mixed with one pint of water. Bandage loosely to prevent the dog licking off the lotion.

# PREVENTION OF CRUELTY TO ANIMALS.

IT requires no argument to prove, that without domestic animals, agriculture would be utterly impossible. It is, therefore, simply in a practical view of the subject, the duty of every one interested in agriculture to employ the best possible means in their power for the improvement and welfare of farm stock, in order that the best conditions and possibilities for the purposes required may be attained. And this improvement and increased value cannot be secured without combining with the skillful breeder's art, intelligent and humane care. Mr. Bergh well says: "Every living creature has assigned to it a limit of endurance and power; and whoever attempts to exceed it, commits a blunder and a sin which is certain to avenge itself at a cost vastly disproportionate to the advantage contemplated.

That agriculture may reap full benefit of the labor of brutes, it is essential to estimate carefully the distance to be traveled, the weight to be carried, and the number of hours in the day, and the days in the week, to which their strength may be profitably applied. There is a universal law affecting the material interests of living and inanimate things, and that is—economy. Transgress this law in any of its relations to this world's affairs, and it speedily avenges itself by wasted physical power, deterioration of the elements of production, sterility, and death. It is a stupid delusion to suppose that any of the laws of the Creator of all things can be subverted or disobeyed by mankind with impunity. You may overwork, overdrive, overload, your patient and submissive animal; but you abstract so much wealth from your possession by so doing.

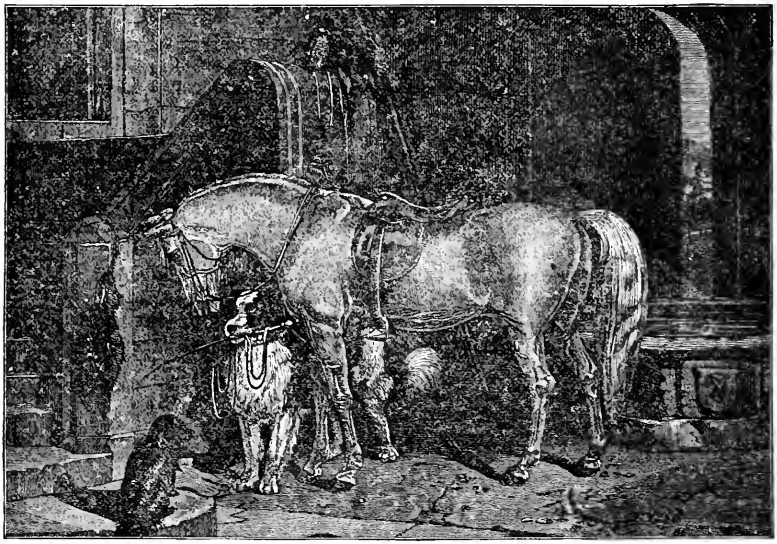
So interwoven and dependent on the brute creation is the prosperity, and even life, of mankind, that often the meanest insect and bird stand sentinel over their property. It would astonish and confound an individual addicted to the wanton destruction of little birds, for example, to learn the value to agriculture of these seemingly insignificant creatures. Permit me to cite an example of the unappreciable utility of only one of them, — the martin, a species of sparrow. From the 15th of April to the 29th of August, eighteen of these birds were once killed, in the stomachs of which were discovered not less than eighty-six hundred and ninety insects destructive to the produce of the farm; which gives, for each day and bird, a total of four hundred and eighty-three insects destroyed. Even though the senseless butchery of these feathered friends of man was done under the pretence of supplying food for the table, imagine, if it were possible, how many bushels of wheat, or barrels of wine, or bales of cotton are represented in each of these little victims."

Aside from the economy and profit to be derived from the humane treatment of the lower animals, no person of correct principle, refinement of feeling, and true sense of justice, would needlessly inflict suffering upon the lower animals, or lend his influence in permitting it. Man is "lord of creation," it is true, to a certain extent, and occupying this high position, it is his duty, as well as privilege, to protect and care for, the creatures that are his willing and faithful servants and subjects. It is surprising how indifferent to cruelty to animals many persons are who profess to be just in all their dealings with their fellow-man, and how many there are who consider themselves good Christians, and are quite conspicuous in their religious zeal among men, who are absolutely cruel and brutal in their treatment of dumb animals. The well-known words of the poet have aptly described the true relation between man and the lower animals:

"A man of kindness to his beast is kind;
But brutal actions show a brutal mind.
Remember, He that made thee, made the brute,
That gave thee speech and reason, formed him mute:

He can't complain; but God's all-seeing eye
Beholds thy cruelty, he hears his cry.
He was designed thy servant, not thy drudge,
And know that his Creator is thy Judge."

How a man can respect himself, or much less consider himself a Christian, who abuses the creatures God has placed under his care, is a wonder to those endowed with a sense of justice and humanity. It is argued by some that there is too much said about the sufferings of dumb animals, that they were made to endure and suffer, and that those interested in the subject of prevention of cruelty to them, greatly exaggerated the evils in this respect, etc. It requires but little observation and reflection however to perceive that animals are frequently greatly abused, and that the half has not been told that might be said in this respect. Animals are not mere machines, without sensation, but are acutely susceptible to suffering, the same as human kind.



WAITING FOR MASTER.

Dr. Chalmers says on this subject: "These sufferings are really felt. The beasts of the field are not so many automata without sensation, and just so constructed as to give forth all the natural signs and expressions of it. Nature hath not practiced this universal deception upon our species. These poor animals just look, and tremble, and give forth the very indications of suffering that we do. Theirs is the distinct cry of pain. Theirs is the unequivocal physiognomy of pain. They put on the same aspect of terror on the demonstrations of a menaced blow. They exhibit the same distortions of agony after the infliction of it. The bruise, or the burn, or the fracture, or the deep incision, or the fierce encounter with one of equal or superior strength affects them similarly to ourselves. Their blood circulates as ours. They have pulsations in various parts of the body like ours. They sicken, and they grow feeble with age, and, finally, they die — just as we do. They possess the same feelings;

and what exposes them to like sufferings from another quarter, they possess the same instincts with our own species. The lioness robbed of her whelps causes the wilderness to ring aloud with the proclamation of her wrongs; or the bird, whose little household has been stolen, fills and saddens all the grove with melodies of deepest pathos."

Aside from a practical and humane standpoint, there is still another consideration of vital importance involved in the subject of kindness to animals, and that is, its reflex influence upon the character of individuals and society at large; for not only are animals kindly treated more valuable and useful every way, but the inauguration of a system of humane treatment of the brute creation has a wonderfully refining and elevating influence upon mankind. For this reason, children should early be taught to be kind and considerate to all dumb animals, for this will aid vastly in establishing correct principles of justice and honor that a child who is permitted to witness and practice cruelty to inferior orders of creation can never possess. The "Bands of Mercy," that are being formed all over the country, enlisting children in their ranks, are exerting an influence in the right direction that can never be computed.

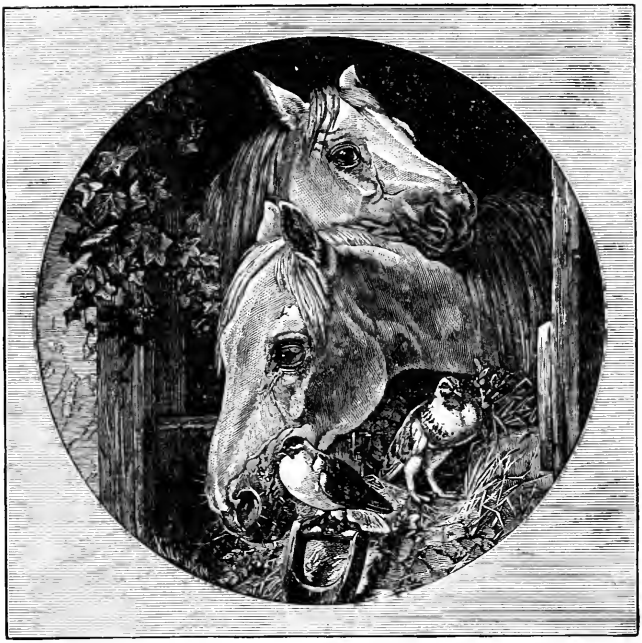
The efforts made by Mr. Angell, President of the Massachusetts Society for the Prevention of Cruelty to Animals, in endeavoring to make it an established law that it be the duty of all teachers in the public schools to teach their scholars to protect insect-eating birds and their nests, and treat all domestic animals kindly, is an example worthy of imitation, and if such a law could be adopted in every State in the Union, the educating and refining influence that would be the result, would indeed be surprising! Besides the enforcement of such a law, societies for the prevention of cruelty to animals should be established in every city and town, not only as a refining and elevating element among the people, but better still, as an active organization for the prevention of cruelty.

History states that the tyrant Domitian, while a mere infant, foreshadowed the evil character that afterwards terrified and horrified the world, in his love of cruelty to flies and other insects by tearing off their wings and legs. It is said that Louis XIII of France when a child once crushed beneath his foot a little tame sparrow that took refuge in his bosom, and that the good king his father, Henry IV, seeing the cruel act, exclaimed to the queen, "Wife, I pray that I may outlive that son, else he will be sure to maltreat his mother." It is well known that the prediction was verified, and that Marie de Medicis died at Cologne at the age of eighty-six, exiled and reduced to the extreme of misery by this son. At the siege of Montauban, he who was the cruel child, now a mature man and a monarch, stood fiendishly by and mimicked the dying contortions of his Protestant prisoners. Surely the child is typical of the man, and if humane influences can modify and form the plastic mind and character of the child, much good can be accomplished to the world. On the other hand, brutal and unkind treatment witnessed or produced by the child or older persons has a hardening, brutalizing influence, the education being in an opposite direction. Pigeon shooting, as practiced in many localities, is extremely cruel and brutal.

A recent writer in commenting upon a pigeon-shooting match, in which several caged pigeons were let loose one at a time to be shot at, says: "There is something in the pleasures and perils of the chase which appeals to that spirit of adventure which has its home in the breast of the boy, and which the mature and sober citizen rarely succeeds in subjugating and suppressing. The pursuit of the nobler varieties of game is a school of courage and endurance, and steadiness of nerve. The heroic element does not manifest itself to any inspiring degree in the slaughter of the more timid birds and animals; but, after all, the shooting of so-called game birds is only following the strong and irrepressible instinct inherited from a barbarian, and, perhaps, a quadrumanous ancestry. Of course it is an unequal contest; but when the game is pursued on its own ground, where it enjoys every opportunity for concealment or escape, and when the generous sportsman so far recognizes the rights of the

pursued that he scorns to take unfair advantages with trap or snare, it comes to a contest between wariness and skill. The pure murderous features of gunning are in this way toned down and wiped out, and the sport loses the taint of brutality. It is difficult, however, to understand how trap-shooting can be considered a manly or ennobling pastime. When birds, which are the very emblems of innocence, are captured alive and then set free in front of the so-called sportsman's gun to be slaughtered, the sport becomes butchery, and pretty coarse butchery at that."

Aside from domestic animals being more valuable and easily managed that are treated kindly, it is wonderful to what an extent their intelligence and sagacity may be utilized and



THE SOCIETY OF FRIENDS.

increased when their education or training is conducted on the principles of kindness. Professor Bartholomew, whose trained horses have excited the wonder and admiration of thousands in this country by their almost incredible exploits, states that the training of them was all done simply by kindness, never by punishment. These horses are sixteen in number, and Professor Bartholomew talks to them as to children, they seeming to understand all that he says. When they do well, he praises them; when they come short of their duties, he censures them, and they evidently distinguish the one from the other. He claims that they know and comprehend the meaning of three hundred distinct words as intelligently as human beings.

The performances of these educated horses are described as follows: They are not

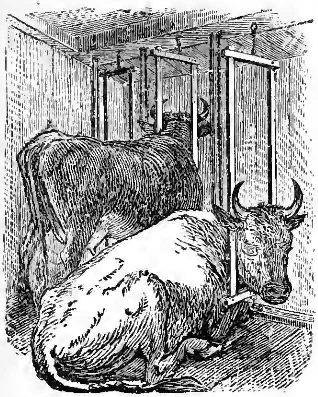
guided by bit or bridle, nor by a significant bearing down of a rider's saddle. The owner and teacher stands remote from them, and by word of mouth calls upon them individually and collectively to go and do certain acts that he has taught them. When the school of animals enters the arena, he singles out different ones by their distinguishing name and bids such go and salute the audience. In response to such command the horse specified leaves his companions, and, coming forward to the "foot-lights," bows to the assemblage. He asks one of the school to "go and open a desk and bring him a handkerchief." Another he commands to take a sponge and rub out some figures on a black board. Another he commands "to march," "to trot," "to run," and by such a simple command the gait changes simultaneously with the request. Another he orders to describe a figure "8" by the movement of his body, and calls upon the audience to say whether he shall describe it by commencing at the right or the left, and as the voice from the audience determines so is it.

He orders four of his horses to go and stand side by side for a game of "leap-frog," and then calls upon one of the audience to nominate some other horse that shall run and leap over all four of them. So soon as one of the horses hears his own name called by some person in the audience, just as soon does the animal named catch the spirit of the "turf," and with an exciting impetuosity he wildly and gladly runs, and with a leap and a bound he clears all four animals amidst the plaudits of the multitude. It is amusing to see the cocked ears of all the horses as they wait the mention of their names. The teacher of this school of animals took a large Geneva music-box, and as soon as it was wound up, these horses grouped themselves around him and endeavored to get their heads into his lap. and when self-posed they listened with wrapt attention.

An immense "see-saw" was arranged in the arena, and at the word of command the horse nominated went up the plank, and when in the middle of it, he stood for five minutes "see-sawing" that plank to the wonder and amusement of every beholder. While thus standing and balancing that huge plank the owner called the name of another horse, and at once the last named got upon the same plank, and the two horses at the extreme ends of that plank stood and "see-sawed" as perfectly and as nonchalantly as two men could. The next scene was very exciting. The owner arrayed himself in a military uniform, and at a bugle-call twelve horses entered, wearing a crimson ribbon around their barrels, and entered with a soldierly step. They at once arranged themselves into a military line and "dressed" right or left pursuant to command. The evolutions, and marchings, and counter-marchings of these quadruped-soldiers, in obedience to oral requirement, were indescribably wonderful and fascinating. They marched with perfect precision in a body. They marched in platoons. They marched in ever-varying sections. They filed "right" and they filed "left," they formed a hollow square, and went through the tactics of a military drill with an exactitude that baffles description.

But the final scene was the climax of all. It was a "horse court." One of the horses was indicted for "murder." The bell rang. The curtain rose and "the court-room" was before you. Six horses were in the "jury-box." The horse charged with murder was in the prisoner's dock, and was fastened with chains. The judge's bench was a lofty structure, and looked like an old-fashioned New England pulpit. In it sat a sober-visaged donkey, with flamboyant ears, looking every inch a judge. The owner charged the jurors and ordered them to retire. At once these educated horses withdrew, but soon afterwards came back into court, and once again entered "the jury-box." The teacher, in behalf of the long-eared judge, now called for a verdict, and immediately thereafter one of the number (the foreman) held up in his teeth a placard, on which was printed "Not Guilty." This placard was handed from "jury-horse" to "jury-horse," and each one received it in his teeth and held it up for public inspection. The owner then commanded that the prisoner be released, and at that word another horse, acting as "Sheriff," went up, and with his teeth unfastened the chains, and the prisoner

came forth and intelligently saluted the audience. These horses go through a mimic battle, capturing a fort, firing the cannon with their teeth, lying down to avoid the enemy's fire, and at last capturing and passing the hostile flag from one to another.


OHAIN HANGING CATTLE STANCHION.

Too much indifference respecting the comfort and welfare of animals that are transported in freight cars is manifested by those having the care of them, they being frequently crowded together so closely as to prevent their lying down, or if they chance to get down, to prevent their getting up; so that it is no uncommon sight to find those that have been trampled to death by their fellows in freight cars, while the poor creatures are kept standing for days together, with but a scanty supply of food or water. Beef or other meat obtained from such sources cannot be regarded as fit for human food. The present custom that seems destined to obviate this difficulty, is that of transporting the beef in refrigerator cars from the great Western markets, instead of sending the animals East and to other sections to be butchered. Cattle are frequently tied in stables in such a manner as to scarcely be able to lie down with any degree of comfort, or to move in an easy manner in any direction. Farmers are generally too indifferent and careless in this respect. Stanchions of some kind that will admit of a free and easy motion of the animals when in the stable are a great improvement on the old method of fastening. The above device, the invention of a Connecticut farmer, seems admirably adapted to obviate all objections of the old time method of fastening.

**How to Kill Animals Humanely.** — Since it is necessary, whether for food or other reasons, to kill animals, it should be done in the most humane manner possible. For the purpose of imparting instructions as to the best methods of doing this, we give the following directions, recommended by Dr. D. D. Slade, Professor of Zoölogy, Harvard College, and one of the directors of the Massachusetts Society for the Prevention of Cruelty to Animals. These directions are intended to give instruction to those who desire to terminate the existence of animals in the most speedy and humane manner, whether such animals are intended for food, or whether they have become useless through age, sickness, or other cause. When we reflect upon the vast number of animals which are put to death in our own country alone, for food, estimated at more than fifty millions every year, not to speak of the thousands that are destroyed for other reasons; and when we bear in mind that a great proportion of these animals are put to death, often with the most needless cruelty, simply through ignorance of the proper method of producing speedy death — it will be readily admitted that an attempt to enlighten the public in this respect may at least serve to diminish the amount of such cruelty, and indirectly lead to other equally satisfactory results. While we write more especially for the farmer, who is from circumstances obliged to slaughter his own animals, and for those who are called upon reluctantly to rid themselves of some fond but disabled pet, we also desire to call the attention of those who pursue the slaughtering of animals as a business to the great necessity of doing their work in the most humane manner possible. To this end, there are certain measures of importance to be kept in view, and to be carried into practice.

**Precautions.** — The animal to be slaughtered should be conducted to the spot selected as quietly as possible, without the use of goad or club, and everything calculated to alarm him

should be removed. All slaughtering premises should be kept thoroughly cleansed from blood and offal, and no carcasses be allowed to hang in view. No animal should be permitted to witness the death of another. Trifling as these measures may appear to the professional butcher, they are in reality of vast importance, not only in view of avoiding useless cruelty, but as affecting the wholesomeness of meat for food, and the market value of the animal slaughtered; there being no question as to the effects of torture, cruelty, and fear upon the secretions, and, if upon the secretions, necessarily upon the flesh.

**Methods.** — The slaughtering of animals for food at the present day may be classified under three methods: 1. Rendering the animal insensible by a blow on the head, followed by bleeding. 2. Cutting through or injuring the spinal cord (pithing), so as to destroy the powers of motion and sensation, with subsequent bleeding. 3. Cutting the throat, deeply dividing all the blood vessels, with or without thrusting the knife into the heart, and without previously stunning the animal. This last method is practiced by the Jews.

From certain experiments conducted for the purpose a few years since in the abattoirs of Paris, it would seem that the first of these methods, namely, that of producing insensibility by some sudden shock to the brain, such as that of a direct and concentrated blow, especially if followed by immediate blood-letting, is attended by less suffering than when death is effected by decapitation, pithing, or cutting the throat without previously producing such insensibility.

A German observer (Dr. Sondermann, of Munich) remarks upon this subject: "All methods of slaughtering have for their object the death of the animal in a more or less speedy, but always in the least painful manner possible. But what is death? and when does actual death occur? Simple as these two questions may appear, they are nevertheless very difficult to answer. A mammal whose head has been cut off by a guillotine does not die immediately. Actual death occurs some seconds or minutes afterwards. All methods of slaughtering, other than the one in which insensibility is produced by a severe shock to the brain, followed by bleeding, produce, without exception, only apparent death, after which follows the actual death, the latter being always accompanied with an entire cessation of nervous and muscular excitability."

**Voluntary and Involuntary Motion.** — There are two kinds of motion. The one is voluntary, and dependent upon the brain. So long as this organ remains unimpaired, so long will consciousness, sensation, and the power of voluntary motion continue. The other is involuntary, and dependent upon the action of the spinal cord as a nervous centre, and is known as reflex action. This kind of motion is exhibited in the movements of animals after decapitation, where all connection with the brain, and consequently with consciousness, has been cut off.

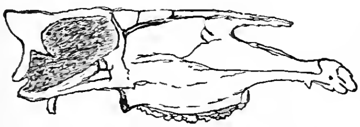
So intimately connected in our minds are pain and action, that in witnessing the slaughter of two animals we are naturally inclined to attribute the greatest amount of suffering to the one that at the time of death exhibits the most violent convulsions. In such a conjecture, however, we may be very much mistaken, for it is possible, nay, even probable, that there may be acute suffering with scarcely a struggle on the part of the animal; while, on the other hand, there may be much struggling, and even distortions, without pain or sensations of any kind, as is often made evident in cases of decapitation where, as we have just remarked, all connection with the brain has been removed.

Thus we see that the movements of an animal in the act of being killed are not at all to be relied upon as evidences of pain.

**Pithing.** — The term "pithing" is applied to two methods of inflicting injury to the nervous system, and thereby producing death. By one method, that most commonly in vogue, the spinal cord is severed or punctured between the first and second bones of the neck,

where the peculiarity of the articulation leaves an opening. This is done by a variety of instruments. Although the animal drops immediately, life continues for some seconds, and even minutes, the heart continues to beat, and the brain to live and act. By the other method, a small spot situated in the lower and posterior portion of the brain is reached and broken up by the introduction of a narrow, sharp instrument. Death is almost instantaneous. "No attempt is made at inspiration, there is no struggle, and no appearance of suffering. The animal dies simply by a want of aeration of the blood, which leads in a few moments to an arrest of the circulation.—(Dalton's Physiology.) Both of these modes of slaughtering, especially the last, require an anatomical knowledge as well as a practical dexterity that but few would attain, and, if they are not properly and quickly executed, are undoubtedly attended by more suffering than by other methods

**Depriving of Sensibility.** — Without entering further into the consideration of physiological questions of so much importance, we may with safety lay down the following proposition, viz.: All animals, when slaughtered, should be deprived of sensibility by inflicting sufficient injury to the brain, either by a sudden and violent blow of the axe or mallet, by the bullet, or by some other equally efficient means, and should then be immediately bled during the state of insensibility.



SITUATION OF THE BRAIN. (FIG. 1.)

It is important to know the exact situation of the brain in animals, so that the shock to this organ may be conveyed effectually and at once, and not by clumsy and ill-directed efforts, as is too often the case. It should be kept in mind that the brain of animals occupies but a comparatively small portion of the entire head. In the attempt to fell them, the tendency is almost always to strike too low. Fig. 1 represents a longitudinal section of the horse's head, showing the situation of the brain, and also the thinness of the frontal bone as compared with the corresponding region in the ox. The horse may be destroyed by blows upon the head, by the bullet, or by chloroform.

1. *By Blows.* — Having blindfolded the horse, the operator, armed with a heavy axe or hammer, should stand upon the side and to the front of the animal, directing his blow to a point in the middle of a line drawn across the forehead from the center of the pit above the eye. (See Fig. 2.) One vigorous and well-directed blow will fell the animal, but the blow should be repeated to make destruction sure.

2. *By the Bullet.* — The operator should stand directly in front of the animal, and place the muzzle of the rifle or pistol within a few inches of the skull, aiming at the spot indicated in Fig. 2. One shot is generally sufficient, if properly directed in either case; if not, it should be repeated after the animal falls. In most instances, so great and instantaneous is the shock to the brain from a bullet that death follows instantly. A shotgun loaded with buckshot is effectual, and may often be more conveniently procured.

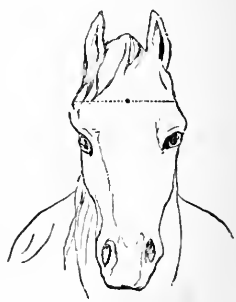


FIG. 2.

3. *By Chloroform.* — Procure a common feed-bag or small sack made of thin cotton cloth, or of any sufficiently strong material, provided with strings or a strap to fasten over the head, and at the bottom of this place a large sponge or a yard of flannel folded to the size of eight inches square. The sponge or flannel is to be saturated with chloroform and the bag adjusted. If the suffocation and consequent struggling, which at first attend the admin-

istration of anæsthetics, are very great, the application of the chloroform may be gradual, the animal being allowed to respire the outward air for a moment, until these effects pass off. As it is by the exclusion of common air, however, that death is produced, the more persistently the administration of the chloroform is kept up, the more speedy will be the desired result. The dose requisite varies very much according to circumstances. At least sixteen ounces of chloroform should be procured, and it should be freshly applied through a small slit in the bag every few minutes until death ensues, which will be from five to ten or fifteen minutes after the beginning of the operation.

The difficulties attending the administration of chloroform to so large and powerful an animal as the horse, particularly at the hands of the inexperienced, render its use less applicable than either of the other methods. In cases where sickness and consequent debility have reduced the animal, and made him less capable of struggling, it answers a good purpose, or where a pet horse is to be killed, and the owner is unwilling that the deadly blow shall be struck, chloroform may be resorted to, but, as a general rule, we do not recommend its use where the normal amount of strength still remains.

**Best Method of Killing Cattle.**—The skull of the ox is thicker and heavier than that of the horse, and the brain still smaller in comparison with the entire head. The frontal bone is composed of two plates, which are separated by bony ridges, forming cells or sinuses. This arrangement (seen in Fig. 3, which represents a longitudinal section of the head), gives to the parts great strength, and forms a secure defence against injuries to the brain, which lies beneath.

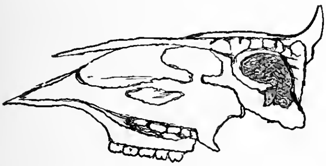


FIG. 3.

Cattle are most readily and conveniently destroyed by blows on the head with a heavy axe or hammer, followed by immediate blood-letting. The animal which is to be killed should be secured by means of a rope passed round the horns and fastened to a post, or, if practicable, carried through a ring in the floor, and held or made fast by an assistant. The animal being blindfolded, the operator, armed with a heavy axe or hammer, stands at the side and a little in front of it, and aims his blow at a spot in the middle of a line drawn across the forehead about one inch and a half below the base of the horns, or, perhaps better, at a spot where two diagonal lines intersect, drawn from the eyes to the base of the horns. (Fig. 4.)


FIG. 4.

In most cases, if the blow is heavy and properly directed, the animal falls instantly; but it is better even then to repeat the blow, and to follow it by immediate bleeding. This is accomplished either by drawing back the head, and cutting deeply across the neck at the upper portion of the windpipe, severing all the blood-vessels, or by plunging a long and sharp-pointed knife into the heart and large blood-vessels at a point corresponding to the upper portion of the brisket, and just above the breast-bone.

Failure to fell the animal at the first blow cannot be attributed to any difference in the anatomical structure of the part, but rather to the fact that the blow was ill-directed, almost invariably too low, that it was not sufficiently powerful, or that both of these faults were combined.

**Slaughtering Calves.**—In the slaughtering of calves it is not a common practice with us, as it is with France and other countries, to render them insensible before bleeding, for fear that the brain may be made less inviting as an article of food by being torn and

stained with blood. By using a broad mallet this may be in great measure avoided, and even if these results do follow, they do not in reality alter the quality of the brain for edible purposes. Objections to the humane destruction of an animal on such grounds are as unreasonable as those which are made to juicy and wholesome red veal by people who prefer that which has been rendered white, dry, and innutritious by repeated bleedings, which have reduced the calf, before death, to a lingering condition of faintness and debility.

The calf should first be stunned by a blow upon the head by a broad mallet or hammer, aimed at a spot relatively the same as in the full-grown animal. This is to be followed by immediate bleeding, by severing the throat at a point corresponding to the upper portion of the windpipe, using a sharp knife and doing the work thoroughly and at once, so as to open all the arteries and veins of the neck.

**Slaughter of Sheep and Lambs.**—Sheep and lambs should be rendered insensible by a blow upon the head, to be followed subsequently by severing the throat, as just advised in the case of calves, or by plunging a sharp-pointed knife through the blood-vessels at either side of the neck between the bones and the windpipe. The place to be selected for a blow is the center of a line drawn across the head about two inches above the eyes, the brain in the sheep occupying a situation posterior to what at first sight would appear to be the natural one.

**Best Method of Slaughtering Swine.**—There is an idea prevalent among farmers, and even among many of those who practice the slaughtering of swine as an avocation, that, if these animals are first rendered insensible by blows upon the head, it is impossible to empty the blood-vessels.

There is no foundation, however, for any such opinion. Any obstacles to bleeding are due, not to material differences in the anatomical arrangement of the blood-vessels, but solely to the difficulties attending the cutting through of the great mass of fat and flesh which characterizes the necks of swine in order to reach these vessels. This very difficulty is a reason why the animal should be rendered insensible before bleeding, not only on the score of humanity, but also on the score of avoiding the barbarous sights and sounds which so frequently disgrace our towns and villages.

In Europe generally, the swine are always first rendered insensible by being stunned. They should be made insensible by a blow upon the head, directed, not between the eyes, but upon a spot in the middle of a line drawn across the head three or four inches above the eyes. A long, sharp knife should then be thrust deeply through the lower portion of the brisket, at a point just above the breast-bone, severing the large vessels leading from the heart. The point of the knife, after it has been thrust in, should be swept about and made to cut more extensively in the deep parts than at the surface. This insures the thorough division of the blood-vessels, and the most rapid and effectual bleeding of the animal.

**Killing Dogs, Cats, etc.**—Small dogs, cats, and other diminutive animals, particularly if sick or in any way disabled, are humanely destroyed by means of chloroform. This substance should be administered by pouring from two to four tablespoonfuls of it on to a sponge or folded flannel, placed within a thick cloth or towel, and applied over the mouth and nostrils. If the struggling is severe at first, the administration of the chloroform may be made more gradual by removing the sponge or flannel for a moment altogether, and then reapplying it; and, as the animal becomes quiet, it should be kept on closely and constantly, to the entire exclusion of the outward air, adding fresh chloroform from time to time until death occurs. The length of the operation will depend upon the size and condition of the animal, and the persistence with which the administration has been kept up.

As a protection against the struggles of the animal to free itself, the body may be placed in a sack or bag, allowing the head to protrude. Or a blanket may be thrown over the body, by which it may be grasped, while the head is left free for the application of the sponge. Or the animal, together with the saturated sponge, may be placed in a small box and allowed to go quietly to rest.

The young of cats and dogs, when but a few days or hours old, may be humanely destroyed by drowning, if properly executed. This can be best accomplished by placing them in a tight bag containing a stone of sufficient weight to insure speedy sinking. The quickest method of terminating the existence of a large dog is, undoubtedly, to shoot him. Place the muzzle of a pistol or rifle within a few inches of the head, at the side, just over and in front of the ear. If directed behind the ear, the ball is likely to glance and pass through the soft parts of the neck, and death would neither be so certain nor so instantaneous as if the brain had been pierced.

In the attempt to destroy it, no animal should be merely maimed. For this reason, if a gun or a fowling-piece should be used, it should be charged with buck-shot, the side of the head aimed at, and sufficiently near to insure speedy death. The same remarks apply to the destruction of cats. As this animal is smaller, however, death may be instantly effected by small shot fired from a gun at the head, sufficiently near to prevent the scattering of the charge.

**Killing Poultry.**—The remarks which we have already made as regards producing insensibility by a blow upon the brain may equally apply to poultry. The almost universal method of killing by chopping off the head of a fowl, and allowing the body to flutter about upon the ground, is not an agreeable sight, and has certainly a demoralizing effect upon those who witness it, especially upon the young and those who are not yet callous to such sights. The same may be said also of the practice of opening the blood-vessels in the necks of poultry, and allowing them to bleed to death more or less slowly. Therefore, to produce insensibility, make use of either of the following modes:

1. Grasp the bird by the legs, place its head upon a block, and strike it a smart, quick blow with a small club, or with some equally efficient weapon, and then immediately sever the head from the body by a sharp cleaver or hatchet. Retain the body in the hand until all fluttering has ceased.

2. Take the bird up, compress the throat between the thumb and finger for a minute. Retaining the grasp, swing the body round several times, and then remove the head as just described. Hence insensibility is produced by suffocation and loss of motion by the twisting of the bones of the neck.

3. A very sharp blow, with a small but heavy stick, behind the neck, at about the second joint from the head, will injure the spinal cord so as to destroy sensation and motion, if properly executed; the head to be afterwards severed from the neck.

4. Hang up the bird by the legs, and thrust a long, narrow, sharp-pointed knife, like a pen-knife, into the brain through the back part of the roof of the mouth. Death is instantaneous. To do this considerable dexterity is required.

**Killing Fish.**—It has been observed that fish which are instantly killed on being taken from the water are vastly superior, in taste and solidity, to those which are allowed to die, as is the universal custom with us. And why should this not be the case? Why should we make a distinction in this respect between animals that swim and those that fly or run? No one of us would think of eating beast or bird that had died a natural death. Various modes of killing fish are practiced by different people. The Dutch, for example, destroy life by making a slight longitudinal incision under the tail by means of a very sharp instrument.

On the Rhine they kill the salmon by thrusting a steel needle into their heads. Fish may be easily destroyed by striking them a quick, sharp blow with a small stick on the back of the head just behind the eyes, or by taking them by the tail and striking the head quickly against any hard substance.

**Poison and Gases.**—We have made no remarks upon the destruction of animal life by means of deadly poisons, as such agents cannot, with safety, be placed in the hands of the unskilled. Neither have we spoken of the use of various gases as a means of humane destruction, such means not being at the disposal of the people generally.

PART IV.

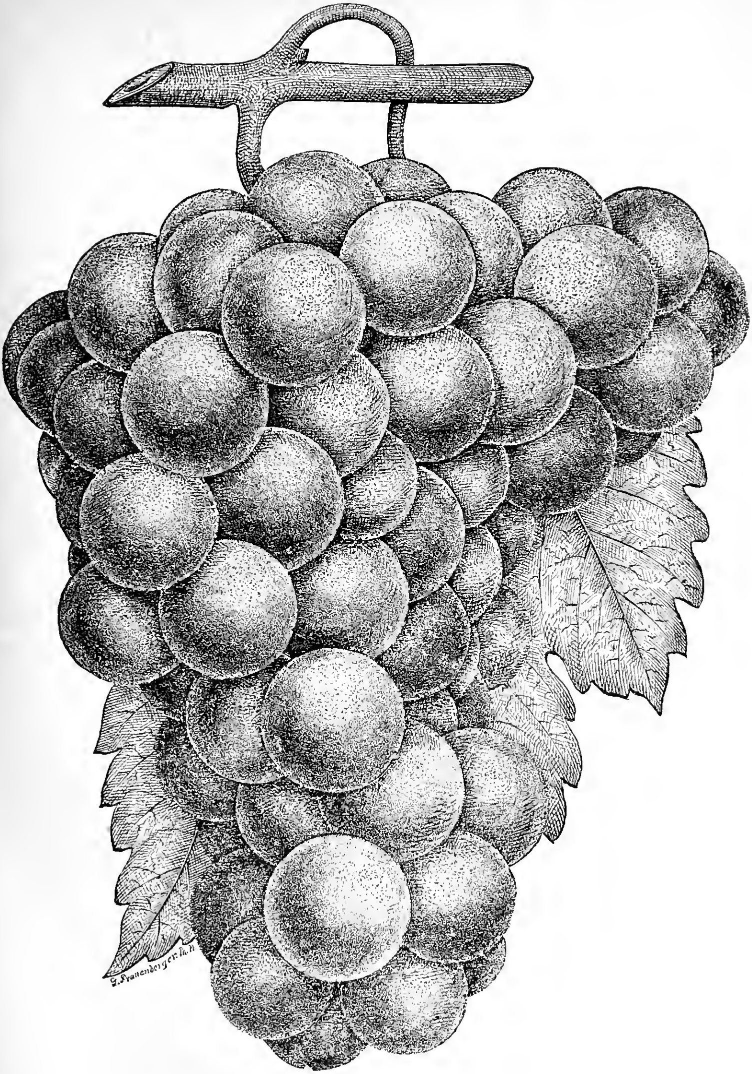
# FRUIT CULTURE.

## FRUIT ON THE FARM.

IT is the occasion of surprise to those who have given a thought to the subject, thatfarmers generally are not more interested in fruit-growing, that they do not take more pains to cultivate in abundance the best of the several varieties of fruit adapted to the climate and soil in which their farms may be located, thus not only providing the means of comfort, health, and nutriment for the family, but also increasing the attractiveness of the home, and furnishing a source of enjoyment to its inmates, as well as profit in farm production, for good fruit will always command a fair price in any market; and not only this, but there is no question but that a farm well stocked with fruit trees, grape vines, and the smaller fruits will find a more ready market when its sale is desired, and will command a higher price than one destitute of these provisions of comfort and luxury, for good fruit is not only a source of enjoyment, but a luxury as well, and one that ali should enjoy. It is a recognized fact, that a good orchard on a farm will do more towards bringing a high price in its sale than many other things that may be much more expensive. The planting of an orchard is a permanent improvement which, when once established, requires, when the benefits derived are considered, comparatively but little expense and labor. A farm without fruit lacks one of the most desirable products of the soil, and seems incomplete and barren of the most attractive feature of a well-conducted farm, however systematic and thorough its management may be in other respects.

The erroneous idea often prevails that fruit, as an article of food, is injurious, and if eaten at all should be taken sparingly; also, that it should not be used by dyspeptics. We believe this opinion wholly unsustained either by reason or experience, and that good ripe fruit, when taken liberally, will not only conduce to health, but longevity as well, and that many diseases, chronic and otherwise, may be entirely cured and avoided by its free use. We have known some of the most obstinate cases of dyspepsia cured by this means. We are glad to know that the old maxim, that "fruit is gold in the morning, silver at noon, and lead at night," though having at present many believers who may variously interpret it, has a smaller number of adherents than formerly, and the number is year by year constantly growing less; also, that the culture and common use of fruit as one of the articles of diet, is becoming more general. Our own experience in using freely all the cultivated fruits is, that they may be eaten with perfect impunity at any hour that any other article of food may be allowed, and when cooked properly may be used by invalids with great benefit; also, that a sick person is often more benefited by a good ripe peach, or a few choice strawberries and grapes than by any drug that the physician may prescribe or the apothecary supply.

Should people generally adopt a more liberal use of good fruit as an article of food, there is no doubt that the present average standard of health would be greatly improved, longevity increased, and many of the now common diseases yield more readily to the effects of the intelligent and skillful treatment of a reliable physician. Fruit should be found on every table as commonly as bread, meat, or any of the other articles of diet; in fact, although bread may truly be regarded as the staff of life,—which can truly be said only of *good* bread.



THE POCKLINGTON.

—(we have seen bread of a quality that might be regarded as the *weapon of death*;) yet we believe that the use of bread even could be dispensed with in a family with fewer injurious results than that of fruit. The apple and grape stand first among the fruits of the northern climate, both in their capacity for production, and their great value as food; being not only heathful, but nutritious; and if our farmers generally would look at this subject in its proper light, in a sanitary, æsthetic, and financial point of view, we believe a more active interest would be taken in it, and new and thrifty orchards would be seen where now there are none or only those of an inferior quality, and many a country home be supplied with an abundance of choice fruit that has formerly had but a limited quantity, and perhaps that only of the most indifferent quality. We would say to farmers generally, cultivate more fruit, and not only this, but fruit of the best kind. It costs no more to grow choice than inferior fruits. Trees and vines of a poor variety extract as much fertility from the soil and require as much care, as those of the very best quality; therefore, in an economical point of view, it is better to plant the very best varieties, although they may perhaps be most expensive at first in purchasing.

Of course, the lack of interest in fruit culture can be imputed to only a portion of the farmers of the country, but we regret to know that this is by far the *largest* portion, and those who appreciate this department of agriculture, and appropriate a fair portion of their lands to its use, compared with other products, are greatly in the minority. While a farm without fruit is deficient in one of the choicest products, its culture may be carried to the other extreme on some farms, and cease to be a means of profit. No farmer with a just view of his business would think of devoting a half or two-thirds of a farm designed for a variety of products, to orchards. The same may be true of any single product of the soil, but the "golden mean" or what might be termed the "happy medium," between the two extremes, —that of no fruit at all, and an unprofitable supply or surplus,—will be found not only a source of health and comfort, but profit. There is also much enjoyment as well as profit attending the duties of fruit culture, an undefined something which results in ennobling and refining the nature of man, creating a taste for the beautiful, as well as the good, for:—

"The good is always beautiful
The beautiful is good."

Hon. Marshall P. Wilder, who has done so much for the advancement of fruit culture in this country, both as a private citizen and as a public official of the American Pomological Society for over thirty years, says in this connection:—

"I know of no better temporal acquisition than a happy rural home,—a home where you may sit amid the fruiting of your trees and the blossoming of your plants,—a home embellished by your own taste, and endeared by pleasures shared in common with the loved ones of your family—a happy country home, with trees and fruits and flowers, where you may find enjoyment, not in hungry greed for gold, not in the conflicts for political distinction, not in the strife for place, power, or renown. For more than fifty years I have trod the crowded marts of trade and commerce. I have shared in the privileges and perplexities of public service, and I have enjoyed the soul-reviving sympathy of family and friends, but I have never forgotten my first love for rural life. Oh, no; whenever I could rescue a little time from the cares of business,—whether at rosy morn, golden noon, or declining day, I have fled to the garden and greenhouse, to my favorite trees and plants, that I might commune and co-operate with nature in her secret laboratory of wonder-working power. This is my idea of a happy, rural home; and this my idea of a happy man,—he who is contented with fruits and flowers reared by his own care, with congenial friends, and a good conscience towards God and his fellow-men. And it has ever appeared to me that contentment and happiness were easily to be acquired by all who really love the cultivation of these lovely objects."

Among the early things that require attention from the farmer in establishing a home,

where there is not already a sufficient supply, is the liberal planting of many varieties of the best fruits, of all kinds, both large and small. And we would advise no farmer in making this important improvement on his new farm, to allow an entire year to go by without its being accomplished if possible, since the sooner they are started in growth, the sooner will he reap the result of his labors, and gather the fruit his own hands have carefully planted, pruned, and tended, and which, it has always seemed to us, tasted a little sweeter than that from other sources, since it has blended with its pleasant aroma and delicious flavor, these most attractive associations. It is astonishing to note the progress made in fruit culture within the last half century, and every year affords additional evidence of the skill of man in the acquisitions of new and valuable varieties, the ease with which they may be obtained, and the degree of perfection that may be reached by careful culture.

Hon. Marshall P. Wilder says in this connection: "Fifty years ago the products of our soil were scarcely thought worthy of a place in the statistics of our country. Now our exports of these amount to nearly six hundred millions of dollars annually, and our western granaries are treasure houses upon which the world may draw to supply deficiencies elsewhere. Then the supply of fruits in our market, excepting apples, was limited to a few varieties and to a few weeks of use. Now our markets abound with fruits for all seasons of the year. Then almost the only strawberry in our market was the wild strawberry of the field, and that limited to a short season. Now we have in variety these delicious fruits, by the facilities of transportation, for two or three months, receiving from the South in a single day five thousand bushels, and from the single city of Norfolk, in Virginia, sixteen thousand bushels, and from our own town of Dighton ten thousand bushels in a year. Then not a single hybridized fruit of the strawberry had been produced, so far as we know, in our land; now so great has been the increase in this period that my register contains the names of nearly four hundred kinds of strawberries that have been under cultivation in my day. Then there were no American grapes cultivated in our gardens except here and there a vine of the Catawba or Isabella; now there are more than two hundred varieties of American grapes in cultivation, and grapes may be had from our shops during more than half the year; and so extensive are our vineyards that, in addition to the production of the grape for the table, California alone produces ten millions of gallons of wine, of which large quantities have been exported to Europe, South America, and Mexico, some of which is mulled over and returned for consumption.

Then the cultivation of the pear was limited to a few varieties, since which the gardens of Manning, Hovey, the writer, and others have embraced more than eight hundred varieties of this noble fruit. Then no exports of fruit of any note had been made. Now, Boston alone has shipped over six hundred thousand barrels of apples in a year, and the export of fruit from this country has amounted to nearly three millions of dollars in a year."

**Production of New and Improved Varieties of Fruit from Seed.**—The only means of securing valuable fruits adapted to the various sections of our country, is in the production of new varieties, which are obtained principally by hybridization, or the cross impregnation of plants. Colonel Wilder says respecting this subject: "The scientific laws upon which this science is founded are as fixed and certain as those of moral and natural philosophy, the same yesterday, to-day, and forever, and although we may not now be able to prescribe the exact limits to which improvement may be extended, we do know that upon the subtle forces of hybridization, either accidental or by the hand of man, we must ever depend for the improvement of our fruits. Natural hybridization, or the cross-impregnation of plants, is as old as creation, and must have given to man the first idea of the power placed in his hand for the improvement of the species. God works by means, in nature and in grace, and requires us to join our efforts with His. 'Seek and ye shall find; knock and it shall be opened to you,' were the original conditions. Nor do we doubt that this art was confided to

man by the Creator, that it might be developed to its utmost extent in the improvement of both animal and vegetable life.

Thus, we are to work, in accordance with His command and that divine wisdom which is ever tending towards a higher state of perfection — nature is the handmaid, man the agent to coöperate with her — and the highest triumph of his skill is to control and elevate her for the benefit of our race. 'It is the part of man to create,' says Ralph Waldo Emerson, 'and his profession as a cultivator of the soil, too, stands nearest to God, the first cause.' The first seeds sown by man were the germs from which sprang the civilization, elevation, and refinement of the human race. So it is with the amelioration and improvement of our fruits. From the sour crab, the puckery pear, the bitter almond, and the austere plum, came the the tender, spicy apple, the melting, juicy pear, the velvet, luscious peach, the delicious purple or golden plum, and from our rank, foxy grape, came the splendid varieties which now adorn our tables and 'make glad the heart of man.'

The laws of reproduction we do not now fully understand, but from the improvement which we have already witnessed we have reason to believe that we have only to become familiar with their operations and our efforts will be crowned with success. There may be a limit beyond which a fruit may not be improved; but the marvel is, that, considering the inferior character of the fruits of former days, we have been able to produce so many of the fine varieties which now grace our exhibitions. And when we take into consideration the number of fine varieties of American origin which have been produced during the existence of pomological societies in our country, we have cause for the greatest encouragement and perseverance.

But great as the acquisitions have been, still greater results are to follow. When we look at the advance in strawberry and grape culture, and the numerous fine kinds which have been originated from seed within a few years, who is not desirous of renewing his efforts in the prosecution of this good work.

It is strange that Duhamel had so little confidence in obtaining good pears from the natural seeds, and we cannot account for his ill success in any other way except that of sowing the seed of poor varieties. But thanks to Van Mons for his enterprise, although the improvement which he claimed from the process of amelioration by sowing the seeds of successive generations of the pear, we believe came from the natural crossing of his best sorts in the same grounds. On my own part, I have to say, that could my life be prolonged for another four score and three years, I would devote them all to the promotion of this most benevolent and interesting employment.

Every year affords us an additional evidence, in the acquisitions of new and valuable kinds, and of the ease with which they may be possessed. These are the only methods by which we can expect to obtain new and improved fruits or to produce substitutes for those which may in time become deteriorated and unprofitable for cultivation. The process of hybridization is simple, whether by the air, insects, or the hand of man, and we have only to have due regard to the characteristics of the parents from which we breed; *plant the most mature and perfect seeds of the most hardy, vigorous, and valuable varieties; and as a shorter process, insuring more certain and happy results, cross or hybridize your best fruits.*

Plant the best seeds of every good fruit,
Good fruits to raise, all lands to suit,
Fruits which shall live, their blessings to shed
On millions of souls when we shall be dead.

These are creations that do the world good,
Treasures and pleasures with health in our food,
Pleasures which leave in the mem'ry no sting,
No grief in the soul; no stain on Time's wing.

For fruitage and flowers let praises arise
From earth's utmost bound to heav'ns highest skies,
Songs of rejoicing where'er they are found,
Songs of thanksgiving where'er they abound."

**Taking Up Fruit Trees.**—In taking up fruit or other trees for transplanting, the first thing to be done is to open a trench around the tree from two to five feet from it, according to the size of the tree, and the spreading nature of the roots. Some trees have the rootlets extending much further than others, different varieties of trees differing fully as much in this respect as the manner of growth of the branches. The trench should be open at sufficient depth to reach if possible the extremities of the spreading roots. An occasional straggling root that extends at a great distance from the trunk may be cut off with a sharp knife. Care should be taken however not to cut off any of the roots too near the trunk, or sever too many. It should also be remembered that it is by the delicate and tender extremities of the roots that trees take up their food, and that the tree is injured more or less by the breaking or bruising of any of their little points, hence the less we disturb the roots and soil about them, the better for the tree.

If we should remove a tree with every fibre entire, it would scarcely afterward show any sign of a change having been made. The small and delicate fibres should therefore be preserved as far as possible in taking up the tree, and the transplanting be done as soon afterward as practicable. The soil between the trench and stem or trunk of the tree should be removed as far as may seem necessary or practicable, care being used not to break or otherwise injure the roots, the roots, as fast as they are liberated being laid on one side, thus working around the trunk. The tree will then be ready to lift from the ground, unless there still be roots that extend downward. When such is the case, further digging may be necessary to a certain extent; when at a suitable distance from the trunk the root may be cut off, and the tree taken out of the ground. When practicable, it is best to secure a portion of the soil with the roots, so as to disturb them as little as possible, and prevent their drying, if the tree is not to be immediately transplanted.

**Preparation of Soil for Transplanting Trees.**—It is highly important that the soil for fruit trees should be such as is adapted to their healthful and perfect growth. It is surprising to note the effect of different soils upon trees and plants, each variety of soil ever holding true to its character; hence, if we wish to plant an orchard in a soil not adapted to the variety of fruit desired to be located there, we must change the nature of the soil, or the conditions naturally affecting it in an unfavorable manner. Nature can be relied upon with safety in this respect, as also upon the changed condition to which the soil may be brought, if that condition is continued, thus entirely changing its original quality or condition.

This renders it safe for those who understand the principles that apply to engage in fruit culture, or any other department of plant growth in agriculture. Notwithstanding the great diversity of soil, this ability to change its character,—even that which may seem almost worthless,—enables persons of every locality to raise their own fruit successfully, of such kinds as are adapted to the climate. Some plants and trees require a wet soil, others dry, but the greater number of those most important to agriculture avoid these extremes, and require a medium in this respect. Some trees keep their roots near the surface, others penetrate more deeply. In preparing the soil for their reception these facts must not be ignored. The character of the land must be studied, and the trees or other crops adapted to it, or the land be made to suit the crop. To ignore all this, and make no distinction, applying the same treatment to all crops indiscriminately would, to say the least, be inconsistent, and be sure to end disastrously. Deep drainage is essential to all wet soils before an orchard can be grown upon it with any degree of success. Unless this preparation is first made, the ground being

cold and wet, the roots cannot penetrate the necessary depth into it, but will be forced by the cold too near the surface, and hence will be affected by the extremes of heat in summer and cold in winter, deriving but little benefit from the soil below the shallow strata of earth they occupy. The trees under such circumstances may grow well for a time, but the conditions are unnatural and uncongenial, and such orchards will invariably be short-lived and unprofitable.

When the soil is such that the roots can penetrate deep into it and find a congenial element of growth and sustenance, it will also admit of thorough cultivation, and the plow may be used close up to the tree without striking and tearing the roots, which will thus have a wide, deep range, secure from heat and drouth in summer, and cold in winter; hence there is a healthy and vigorous growth, and such orchards, other conditions being equal, are long-lived and productive. Thorough preparation of the soil should be made if necessary before setting out an orchard; this can be afforded, since it is to last during the lifetime of the trees, and not like grain and other crops to be repeated yearly. In deep, rich, mellow soil but little preparation will be necessary. Some of the most successful fruit-growers recommend land for orchards where a hoed or grain crop has been grown a year or two previous. Green lands where the sod has been turned under six or eight months before the time of transplanting, thus having had sufficient time to become decomposed, is also good.

It is quite essential that the soil should either be deeply plowed or spaded. Trees may also be planted in sod land when necessary; in such cases, if the sods on being replaced, are reversed, and covered with a thick mulch, they will generally rot in a short time. In digging the holes for setting the trees, care should be used to make them large and deep enough to give plenty of range to the roots. The good surface soil should be kept separate from the poorer subsoil, the surface soil to be well worked in about the roots, the subsoil not to be used at all if of very poor quality. It is a good plan to put bones lightly covered with soil in the bottom of the holes which, being under the roots, will by their gradual decomposition furnish nutriment for the growing trees for years. Wood ashes, muck, partially or thoroughly decomposed chip dirt are also excellent, these being much better than stable manure for the purpose. Strong or unfermented manure should never be placed in direct contact with the roots, but if used should be first covered with the soil. As trees are so long-lived they are well worth careful planting.

An extensive fruit-grower says: "The best fertilizer to use in setting fruit-trees of all kinds is partially or thoroughly decomposed chip dirt. We made use of the material for the first time some twenty years ago in planting an apple orchard, and it was a wonder to those not in the secret what caused the trees to make such a fine growth the first season, and afterward, too, for that matter. The experiment was so satisfactory that when we set out our new orchard, we made a liberal use of this material, with the same satisfactory result. These trials have proved to our satisfaction that chip dirt is the very best material to mix in the soil as you plant the tree that can possibly be used, for the reason that it holds moisture, and is full of plant food; therefore, it promotes a most luxuriant, natural, and healthy growth. Repeated trials have satisfied me that a tree is not only more likely to live, but will make double the growth the first year (especially if a dry season) if some two bushels of chip dirt are properly used in its setting, than it would without it. A single trial will convince the most skeptical that the best possible use that can be made of this valuable material is to apply it to the soil in planting trees in order to push forward the tree during the first precarious stages of its growth."

Always select the most vigorous trees for planting. If there are any bruised or broken roots, it is well to cut them off before planting, always cutting from the under side, the bottom of the excavation being regulated to leave the soil a little the highest in the center. Arrange the roots as far as possible in their natural position, the trunk being steadied by the land, the lowest roots being first sought out and laid outward in radiating lines from the

stem and distributed equally on all sides; fine, rich soil should be thrown upon the roots as they are thus placed and covered. The soil covering the roots should be gently pressed down, and another set of roots higher up be laid in the same manner, and so on, until all the roots are well covered, and firmly imbedded in the soil. The tree should never in being planted, be pulled up and down, to settle the soil, as is sometimes done, but the soil should be carefully and firmly pressed around them, either with the hands or by gently treading upon it. When the excavation is two-thirds filled, it is a good time to place a support for the stem of the tree, either by a single stake or three, according to its size.

Water should also be turned in and allowed sufficient time to settle the soil closely about the roots, after which the hole may be filled up and the soil pressed down with moderate treading. When well set the surface should be left slightly rising towards the stem of the tree, to allow for the subsequent settling of the soil. When the soil is well settled the trees should be left about the same depth as they originally grew, except dwarf pear trees, which by planting from two to four inches deeper than the original depth a larger growth can be obtained. In planting an orchard, avoid placing the trees in the same spot or near where an old tree previously stood, since the vigorous growth of the young tree will require an element from the soil that has already been largely extracted in promoting the growth of the former tree; hence if occupying the site of the old tree, the growth of the young tree will be slow and feeble.

Fruit trees are generally planted in the spring from the middle of March to early in May, and in the fall from early in October until as late in the season as the ground will admit. When the planting is done in the fall, it will be of great benefit to the trees in a cold climate, especially during the first season, if a mound of earth, a foot or more high be raised about the trunk as a protection. When the planting is done in the spring there are many trees that will produce a much more rapid and strong growth the first season, if at the time of planting or immediately after, the trees are pruned, cutting out all except from three to five of the main branches and then from a third to a half of the previous year's growth. In fall planting this pruning should be deferred until spring. By setting out a few fruit trees every year a good supply of fruit can be had continuously on any farm, while the labor and expense attending it would be comparatively very slight. The old trees of the orchard should be removed as fast as they become useless.

**Proper Size of Trees for Transplanting.**—With respect to this subject, Mr. Downing says: "The proper size for transplanting varies somewhat with the sort of tree and the kind of culture intended. It is, however, a maxim equally well settled, both among theorists and the best practical men, that health, immediate vigor, and duration are all greatly promoted by transplanting fruit trees of small size—from three to six or seven feet. We are fully aware with what impatience the beginner, or a person who knows little of the culture of trees, looks upon trees of this size—one who is eager to plant an orchard and stock a garden with large trees, thinking to *gather a crop the next year*. The latter may indeed be done; but the transplanting so affects the tree that its first scanty crop is followed by a long season of rest and feeble growth, while the plantation of young trees is making wood rapidly, and soon comes into a healthy and long-continued state of productiveness—often long indeed before the large trees have fairly arrived at that condition. The small tree, transplanted with its system of roots and branches entire, suffers little or no check; the older and larger tree, losing part of its roots, requires several years to resume its former vigor. The constitution of the small tree is healthy and unimpaired; that of the large is frequently much enfeebled. A stout and vigorous habit—what the nurserymen call a *good stocky plant*—is the true criterion of merit in selecting fruit trees for transplanting.

Trees intended for orchards, being often more exposed than those in gardens, should be somewhat larger—not less than six nor more than eight feet is the best size. For gardens,

all experienced cultivators agree that the smaller size is preferable; we prefer plants two years old from the graft. Most gardeners abroad, when they select trees with more than usual care, take what are called maiden plants — those one year old from the graft — and there can be no doubt that, taking into account health, duration, and the ease with which such a tree can be made to grow into any form, this is truly the preferable size for removal into a fruit garden. But we are an impatient people, and it is not until after another century of trial and experience in the culture of fruit trees that cultivators generally in this country will become aware of the truth of this fact.

The facility with which the different fruit trees may be transplanted differs considerably. Plums are generally removed with most success, and after them nearly in the order as follows: Quinces, apples, pears, peaches, nectarines, apricots, and cherries; the latter succeeding with some difficulty when of large size."

**Resuscitating Trees and Plants.** — When trees and plants have become dry and shriveled from their roots being long exposed to the air before transplanting, they may be resuscitated by burying them entirely in damp soil for two or three days, or placing them in water for from twelve to twenty-four hours. When received from the nursery in a frozen state, let them thaw out gradually in a cold, damp atmosphere, or in cold water.

**"Heeling In" Trees and Plants.** — It may sometimes happen that packages of trees and shrubs will arrive from the nursery before the ground is ready for transplanting. Under such circumstances it is frequently the practice with fruit growers to what is termed "heel in" the trees, etc. The well-known nurseryman, Mr. R. H. Haines, recommends the following method of doing it:

"Dig a trench 12 to 18 inches deep, and place the roots of the trees in it, with tops reclining at an angle of 45 degrees. Cover the roots with soil, and, in the new trench thus formed, place another layer of trees, and so on, until all are 'heeled in.' If trenching them in, in the fall, to remain all winter, the soil should be well filled in among the roots, and banked up high over them."

**Distances Apart for Planting Trees, Shrubs, etc.** — The distances apart for planting trees, etc., will depend, of course, upon the variety and the amount of space required for their successful growth. Allowance must be made for their mature growth, and for the admission of air and sunlight, overcrowding to be carefully avoided, this being the fatal mistake too frequently made in transplanting. The following distances are generally regarded as the standard:

| | | | |
|---|---|---|---|
| Apples, | 30 to 40 | feet by | 30 to 40 |
| Apples (dwarf), | 8 to 12 | " | 8 or 10 |
| Pears (standard), | 18 or 25 | " | 18 to 20 |
| Pears (dwarf), | 8 or 12 | " | 8 or 10 |
| Plums, | 14 to 18 | " | 14 to 18 |
| Peaches, | 14 to 18 | " | 14 to 18 |
| Cherries, | 18 to 25 | " | 16 to 20 |
| Quinces, | 8 to 14 | " | 10 to 14 |
| Apricots, | 14 to 18 | " | 14 to 18 |
| Nectarines, | 14 to 18 | " | 14 to 18 |
| Grapes (stakes), | 6 or 8 | " | 6 or 8 |
| Grapes (trellis), | 8 to 16 | " | 10 to 16 |

| | | | |
|---|---|---|---|
| Raspberries, | $3\frac{1}{2}$ or 4 | feet by | $3\frac{1}{2}$ or 4 |
| Raspberries, | 6 or 7 | " | 5 or 6 |
| Blackberries, | 5 or 6 | " | 5 or 6 |
| Blackberries, | 7 or 8 | " | 2 or 3 |
| Currants, | $3\frac{1}{2}$ or 4 | " | 4 or 5 |
| Gooseberries, | $3\frac{1}{2}$ or 4 | " | 4 or 5 |
| Strawberries, for field culture, | 1 to $1\frac{1}{2}$ | " | 3 to $3\frac{1}{2}$ |
| Strawberries, for garden culture, | 1 | " | 2 |
| Rhubarb, | 3 or 4 | " | 2 or 8 |
| Asparagus, | 2 or 3 | " | 1 or $1\frac{1}{2}$ |

The number of trees or plants required for an acre can be obtained by multiplying the number contained in one row by the number of rows. Another method is to divide the number of square feet in the plot to be planted by the number of square feet to be given each tree or plant; thus, strawberries planted three feet by one occupy three square feet of ground each, and since an acre contains 43,560 square feet, this number divided by 3 gives 14,520 as the number of plants required for one acre. Multiplying the distance in feet between the rows by the distance the plants are apart in the rows, will give the number of square feet occupied by one tree or plant.

**Plans for Orchards or Fruit Gardens.** — An excellent plan for laying out orchards is to plant apple trees from thirty to forty feet apart each way; then in the rows, half way between, plant a Standard pear. Crossways, half way between the apple trees, a peach or dwarf-growing tree may be planted. Opposite the pear trees some small tree could be set, such as the dwarf pear, plum, peach, cherry, or quince. Small fruit, such as raspberries, blackberries, currants, or gooseberries may be planted in each row of trees, and three or four rows of strawberries in each space, thus utilizing the entire surface. By the time the apple trees will require most of the ground the peach and dwarf trees, as well as the small fruit, will be through bearing, while the pear and cherry trees — the branches of which are of upright growth, requiring comparatively little room — will not be apt to interfere with the apple trees. The following plan is recommended by Mr. Wm. Parry, of New Jersey, well known in the horticultural world, who says:

"The advantages of planting fruit trees on this plan will readily be seen. By setting the apple trees thirty feet apart, and filling in with smaller-growing trees, the Standard pear occupying the space between the four apple trees, and, being an upright, pyramid grower, they do not interfere with each other.

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PLAN FOR ORCHARDS.

*O*, Apple. *S*, Standard. *D*, Dwarf Pear, Plum, or Peach.

One acre will contain, at 30 feet apart, 48 Apple Trees, 35 Standard Pears, 82 Dwarf Pear, Peach, etc.

Twenty years ago I planted an apple orchard, setting the trees forty feet apart each way; I then set a row of Richmond cherry trees each way between them, requiring three times as many cherry as apple trees; then a row of Dorchester blackberries in the rows and between them, being ten feet apart; then a row of strawberries between them, leaving five feet of space for cultivation. The next year the strawberries produced the only crop gathered, they yielding $200 per acre. The year following the strawberries yielded about half as much, and after picking the fruit the vines were plowed under, and turnips planted in July, which produced a good fall crop. The same year the blackberries commenced to bear a little, and sent up a vigorous growth of canes, which gave a full crop of fruit the succeeding year, and continued to do so for five years, yielding over $200 per acre annually. The next year they did poorly, and were removed, to give more room to the trees, which then sufficiently occupied the ground.

The cherry trees commenced bearing the third year, and have borne full crops every year since, the quantity increasing each year with the size of the trees. For several years the fruit has been worth from $200 to $300 per acre, and sometimes more. One year we contracted with the proprietors of a canning factory near by for the whole crop, at ten cents per pound; there were eighty trees to the acre, and many of them yielded seventy-five pounds each.

The apple trees have made a fine growth, and bear large crops of fruit. The cherry trees in the apple rows begin to crowd them, and will soon be removed, while those standing in the center of four apple trees will have plenty of room for many years, and can remain, leaving as many rows of cherry trees forty feet apart as of apples on the same ground. By pursuing the above plan, there may be taken from $200 to $300 worth of fruit per acre annually, before the apple trees acquire size enough to bear much fruit, and thus avoid the usual objection urged against the planting of apple orchards, viz.: that it requires so long a time before any profit can be derived from the land thus occupied. The same principle will apply to any distance between 30 to 40 feet, and each planter can decide for himself according to the ground to be devoted to fruit. As the heaviest draught upon the soil is when the fruit is ripening, if all matured at once they might exhaust it of moisture and nourishment; but as they ripen gradually, following in succession, the intervening showers supply each crop as well as if there were no other. By this plan we get 165 trees to the acre, and it is much easier and cheaper to fertilize and cultivate 165 trees on one acre than to have them spread over 5 or 6 acres, to say nothing of the land saved for other crops. Every farmer should have at least one acre of orchard on the above plan, which should yield $5 per tree. But at half that sum they will give more than $400 per acre, with less labor than other crops that yield but small returns."

Where the space is limited, such as in the suburbs of large towns and cities, a number of trees may be planted by setting out a row a few feet from the fence, and extending around the entire plot. Raspberries or other small fruit may be grown also to the fence and between the rows of trees. By setting dwarf or small-growing trees on the south side of a garden, a vacant space may be reserved in a small garden for vegetables.

In localities exposed to cold and severe winds, it is well to plant a row of rapidly-growing evergreens, such as pine or spruce, on the north and west sides of an orchard, as a protection, the trees being set from five to fifteen feet apart.

Ralph Waldo Emerson, in referring to this method of protection to fruit trees, says: "This shelter creates a new climate. The wall that keeps off the strong wind keeps off the cold wind. The high wall, reflecting the heat back on the soil, giv ; that acre a quadruple share of sunshine,

'Enclosing in the garden square
A dead and standing pool of air,'

and makes a little Cuba within it, whilst all without is Labrador." A high, close board fence on the north and west sides of an orchard will also prove a great protection from the cold winds, but for large orchards the evergreen trees, closely set so as to break the force of the wind, are better.

**Mapping Orchards and Labeling Trees.**—A small map of an orchard, giving the relative location and kinds of trees, will be found of great convenience. Such a map should be made at the time of planting, or shortly after, before the labels are obliterated or lost. The trees should all be labeled, but the wires of the labels should be put on quite loose and never be left on so long as to permit them to girdle the tree. Neglect in this respect has ruined many valuable trees. The most durable labels are made by writing on zinc with a common lead pencil. The form of label used by nurserymen in some localities consists of a triangular piece of zinc five inches long, three-fourths of an inch at one end, and tapering to a point at the other. The small end may be curled around a branch, and will easily keep its place, while it will expand as the branch increases in size, and thus girdling is obviated. Such labels can be easily cut out of a sheet of zinc with a pair of shears. When tin labels are used in place of zinc, the name should be written with a sharp-pointed nail or awl. It is a pleasure to know the names of the different varieties of fruit grown, while the fruit will often find a better market when the variety is known.

**Cultivation.**—It is quite as essential that fruit trees should receive cultivation as any other crop grown upon the farm. It is too frequently the case that after planting the trees they are left to care for themselves almost wholly. Frequent cultivation will add much to the growth of a young orchard, while the fruit, when old enough for bearing, will not only be more abundant, but of better quality. The cultivation should, however, be shallow in order not to injure the roots that lie near the surface of the soil. Col. Wilder maintains that ordinary farm culture will not produce the highest class of fruit, and says, "they must have garden culture, and with this they never fail. After thorough preparation, the cleaner the culture the better, and this should be shallow, so as not to injure the roots, but to preserve them near the surface."

It has been estimated that one plowing and five harrowings in a single season are equal, in their effects upon an orchard, to from ten to fifteen loads of barnyard manure. A shallow plowing in spring may be sufficient, and cultivators and harrows do all the work for the rest of the season. Seeding an orchard down to grass is not to be recommended, except it may sometimes be done, when necessary, in case of apple and cherry trees after they commence bearing, to check the growth of other fruit trees, and to secure productiveness after a too vigorous growth. Very good crops of plums, pears, and quinces may, however, be obtained when the fruiting trees are grown in grass, provided a good top-dressing of manure or other suitable fertilizers be applied each year.

**Mulching.**—This consists of covering the ground around the trunk of the tree with coarse material, such as straw, leaves, or litter from the barn-yard, which, by preventing evaporation, keeps the earth moist, and also the elements of growth in the soil in a soluble state; besides, the soil is also kept at a uniform temperature, all of which conditions are favorable to the growth of young roots and the production of good fruit. Mulching is an excellent practice for all transplanted trees, and especially for those planted in the fall or late spring, the roots thus being kept warm in winter, and secure from drouth in summer. It is also especially beneficial to young trees in the Southern States, where the hot sun in summer might cause them to fail after having made a fine start earlier in the season.

**How to Promote Fruitfulness.**—When it is desired to have fruit trees commence bearing sooner than they otherwise would, certain methods, more or less effectual, may be resorted to in securing this object. Mr. R. H. Haines, a nurseryman of extensive experience, gives the following directions as the result of his experiments in this direction: "The pinching in of side shoots is one of the best ways of causing fruit buds to form. Another method is to fasten a ligature tightly around some of the branches. Another plan is to bend the branches, keeping the tops fastened down with weights lower than the bases of the branches. Another way is to make a circle of a branch, fastening in that way for a while. By partially breaking or twisting young shoots, the sap may also be retarded from fruit buds.

If many trees are to be treated, then the more common way is to cease cultivation, and to sow the ground with clover or grass seed, allowing it to remain in sod for two or three years Any of the above plans will cause the trees or branches treated to produce fruit while younger than they otherwise would, if fruit buds or spurs had previously been absent. *Pruning the roots* in the fall or winter by digging a trench half way around or entirely round the tree, is an excellent way for treating entire trees or orchards. The trench may be made from three to six feet out, according to the size of the tree, and leaf-mould, rich soil, or some compost may be thrown in before filling up. One pruning of the roots is usually sufficient, though in succeeding years it may also be performed if desired. A top-dressing of two bushels of salt per acre every year or two, or of lime, often seems to have a good effect in promoting fruitfulness, though less speedy and less certain than some of the above-mentioned methods."

**Renovating Old Orchards.**—Old, neglected orchards can frequently be made profitable for several years by proper care and cultivation. Too many moss-covered, barren orchards, that were formerly productive, are to be seen in many parts of the country, which, by proper care, could be made productive for years. The hard sod should be plowed up and made mellow, admitting the air and moisture, and a liberal supply of plant food in the form of manure may be applied. Barn-yard manure, muck, or loam, which has been used as an absorbent of the liquid manure of the stables, the material from the compost heap, decomposed chip-dirt, lime, salt, iron filings, etc., are all excellent for this purpose. If farmers would save more of both the liquid and solid manure from their stables that now are wasted, many of them would have three or four times the quantity for use that they now have for the different farm purposes. Give the old orchards a new and plentiful supply of food in a substantial top-dressing, and a great change in productiveness will soon be observed.

The moss should also be scraped from the trunks with a blunt hoe or a sheet of iron made to fit the tree. The borers may also be killed with a knife or wire. The bark of the trees should be washed with diluted soft-soap, mixed with a little sulphur, or potash water. All sprouts should be cut away from the base of the tree, and if pruning has been previously neglected, the decaying limbs should be sawed off; thus by thinning out the branches and admitting more sunlight, the roots will be better enabled to support a more vigorous growth in those that remain. By such treatment we have known old orchards to become apparently rejuvenated and brought into a fine state of vigor and productiveness.

**Changing the Bearing Year.**—With most varieties of apples, and also some other fruits, there is generally a heavy yield every alternate year, which is commonly termed "the bearing year." This is doubtless due to the exhaustion caused by the excessive crop produced; hence time is required for the tree to recruit, and collect a sufficient supply of the proper material from the soil, water, and atmosphere, to form a new supply of fruit buds, and contribute to their growth and full fruitage. When half the fruit is thinned out, leaving only a moderate crop, the fruit will not only be large and more perfect in form, but there will be a tendency to fruit production the following year; consequently if on the bearing year of a single tree, or a whole orchard, nearly all of the early formed fruit or blossoms are picked off, allowing them to remain on the alternate or non-bearing year, the habit of production in that year will usually be formed after a few such trials. This work is comparatively easy on young trees which have small crops and are more accessible than old ones, and is more likely to produce a permanent change than an old tree with fixed habits.

If a moderate annual crop is desired, the young fruit should be thinned out, if the trees are liable to overbear, and good cultivation given, together with an application, every spring or fall, of manure or wood ashes, salt, and oyster-shell lime to the soil above their roots. It is quite desirable to be able to furnish fruit for the market when there is a scarcity, since it will at such times command a much more remunerative price.

A fruit-grower in Pennsylvania gives the result of testing the above plan for producing crops on alternate sides of apple trees: "Many years ago a neighbor near me tried an experiment on his trees with complete success. His trees, as usual, bore more apples during the even year than he could make use of and in the odd year not enough So he went to work and picked off all the apples he could see from the south side of the tree when they were about the size of hazel or hickory nuts. The result was that his trees for many years bore full crops annually *on alternate sides.* As I frequently saw the trees before and afterwards, I am satisfied that it was a success in his case. Probably this operation would succeed best if performed in the even year, or when the trees have too heavy a crop"

We see no reason why the above plan should not prove a success, although the quality of the soil, cultivation given, and other conditions largely modify the amount of fruit produced in any season.

**Pruning.**—When performed in the proper manner and at the proper time, pruning is very easy and simple work, but the indiscriminate cutting of trees, so frequently practiced under the name of pruning, is very injurious, and often ruinous to trees. Pruning is usually practiced for the purpose of regulating and improving the form of healthy, luxuriant trees, and of increasing the vigor of feeble trees. It increases the vigor of trees in two ways, first, by directing the entire supply of nourishment to a smaller number of branches, which cause them to grow with greater luxuriance; and by enlarging and expanding the small sap channels of weak, feeble trees, by having all the force of the circulating fluid thrown into a smaller number of branches and buds, thus causing larger sap-vessels, new and more luxuriant shoots, and adding increased vigor, which will be apparent for a long time. Pruning is especially valuable to small trees of a stunted growth, but it should also be judiciously performed in order to be beneficial and prevent injury.

**Best Time for Pruning.** — It is generally conceded by the most successful fruit growers that the best time for pruning, in order to promote growth and to insure a perfect and ready healing of the wood, is early in the spring, or as soon as the severity of winter has passed. If delayed until after the buds begin to swell, the sap being in full flow, there will be a loss of sap by bleeding that is very injurious to the trees in lessening their vigor, and in some trees causing a serious and incurable disease of the limbs. Fall pruning is usually done in the latter part of October, or in November, shortly after the leaves have fallen, but as previously recommended, it is better to have pruning deferred until the close of winter, before the buds begin to swell.

Summer pruning is applicable to young orchards, and when practiced consists of directing the main flow of sap into a few shoots in each branch by pinching off the ends of all other shoots when two or three inches in length. In pruning, it must be borne in mind that the direction in which a bud or shoot points, determines the direction of the growth of the branch. It is better to prick or break off these tender shoots rather than to cut them off with a knife or shears. Young trees that are pruned in this manner require but little pruning in the following spring, and then only for two or three years, after which time summer pruning will generally be sufficient.

**Methods of Pruning.** — Pruning should commence when the tree is quite small, and there should be a constant watchfulness to keep down all shoots which are not permanently wanted on the tree; by this means the tree can be trained into almost any form desired. We do not, however, approve of interfering much with the natural form of the tree, but to prune sufficient to eliminate such buds and shoots as shall appear in those places where it is not desired that they should grow, and to prevent a too heavy growth of limbs. Many buds may be rubbed or pinched off in summer, thus avoiding a waste of a season's growth in deferring pruning until the following spring.

The effort of the pruner should be directed towards removing all weak branches, and those that by crowding interfere with the growth of other branches. Such branches as are not allowed sufficient room for natural growth should never be left to attain a large size, thus taking that amount from the vigor and life of the tree before being removed, but should be taken early in their growth. It is easy to perceive that by taking off a limb two or three inches, or even an inch in diameter, is involving a needless waste of the vital forces of the tree; for if it had been removed when a tender shoot, the material used in forming such a branch could have been supplied to the permanent branches, and thus the forces all economized in increasing the vigor, size, and productiveness of the tree. Besides, the cutting off of a large limb causes a wound that will not readily heal, and frequently results in premature decay of the trunk.

In pruning, all the sprouts that do not seem strong and vigorous should be removed, or

those that attain a crooked growth. The top of the tree should not be left so dense in branches that when in full leaf the sunlight cannot enter to ripen the fruit. Fruit that grows in the shade is never as fine flavored or beautifully colored as that which is exposed freely to the sunlight. To go to the opposite extreme, and cut out the branches too much, leaving them too open, there will not be sufficient protection to the bark from the cold winter winds, and the burning heat of summer. Good judgment and an intelligent understanding of the business are essential to the most successful use of the pruning knife.

Mr. Downing says: "A judicious pruning, to modify the form of our standard trees, is nearly all that is required in ordinary practice. Every fruit tree, grown in the open orchard or garden as a common standard, should be allowed to take its natural form, the whole effort of the pruner going no further than to take out all weak and crowded branches; those which are filling uselessly the interior of the tree, where their leaves cannot be duly exposed to the light and sun, or those which interfere with the growth of others. All pruning of large branches in healthy trees should be avoided, by examining them every season and taking out superfluous shoots while small. Mr. Coxe, the best American author on fruit trees, remarks very truly: 'When orchard trees are pruned, they are apt to throw out numerous (superfluous) suckers from the boughs in the following summer; these should be rubbed off when they first appear, or they may easily be broken off while young and brittle — cutting is apt to increase their number.'

Where pruning is not required to renovate the vigor of an enfeebled tree, or to regulate its shape, — in other words, in case of a healthy tree which we wish to retain in a state of the greatest luxuriance, health, and vigor, — it may be considered worse than useless. Bearing in mind that growth is always corresponding to the action of the leaves and branches, if these are in due proportion and in perfect health, the knife will always be found rather detrimental to luxuriance and constitutional vigor than beneficial.

Ignorant cultivators frequently weaken the energies of young trees, and cause them to grow up with lean and slender stems, by injudiciously trimming off the young side shoots and leaves in the growing season. By taking off these shoots the stem is deprived of all the leaves which attract and elaborate the sap, thus preparing nourishment for the growth of the stem; and the trunk of the tree does not increase in size half so fast as when the side branches are allowed to remain for a time, pruning them away gradually. It is better, in the case of these young trees, to *stop* the side branches, when of moderate length, by pinching out the terminal bud."

We have seen trees so pruned that their form was shorn of all beauty and grace, and instead of being an ornament to the landscape, and a pleasure to the eye, as they should be, were really a blemish to the locality in which they were placed, and an offence to good taste and judgment. A sharp pocket-knife will be all the tool essential for pruning young trees for some time; but after attaining a larger growth, pruning shears and saw will be necessary. In pruning old trees that have been long neglected, it may be necessary to cut away considerable from the top in order to bring them into good form and thin out the branches sufficiently to admit the sunlight, and also to remove the decaying limbs.

**Wash for Wounds made in Pruning.** — In pruning large limbs, the wounds should always be covered with some kind of a wash or composition that will keep out the air, prevent the wood from cracking, and maintain it in a healthy, sound condition until a new layer of bark covers it. The following composition is the best we know for this purpose, as it soon becomes hard, adheres closely to the wood, is not affected by the weather, while at the same time it does not prevent the new bark from gradually closing over the wound, and covering it: Dissolve as much gum-shellac in a quart of pure alcohol, as will make a liquid of the consistence of paint, and apply it to the wood with a brush, being careful to have the surface

smooth, and well covered. If kept in a well-corked bottle, it may be preserved any length of time, and be conveniently at hand when needed.

**Propagation.** — The most common means for propagating fruit trees is grafting and budding, although there are several different methods employed for this purpose. Strictly speaking, there are but two methods of propagating trees and plants, and these are by planting seeds, which is the natural process, and by the means of buds, which is for the most part an artificial process. The latter is the better method, since the seed of fruit will rarely produce fruit of the same kind, while a long time is also required for the tree to reach maturity; while by grafting a bud or scion into the branch of another tree, the fruit that may be produced will be very similar to that of the original source. Less time is also required for the grafted bud or scion to reach a bearing age, than for the seed to produce a natural tree. Grafting consists in inserting a scion of one variety or species on a branch or stem of another, the latter being called the stock. The latter may be of all ages from a seedling of a year's growth to a full-grown, aged tree, but in order to insure success the stock should be sound and healthy.

The propagation of fruit by grafting is of very ancient origin, having been well known and practiced by the Greeks and Romans, and although many new methods have been devised since that period, many of those described by the Greek and Roman writers are fully as ingenious as those employed at the present time. It is said that the French, who are noted for their skill in grafting, are familiar with from fifty to seventy-five different methods of propagating fruit and plants by this means. The principal methods employed for propagating specific varieties of the larger fruits are by grafting and budding; and for small fruits and vines are by cuttings, layers, and runners, the use of buds being required in all of these methods.

The tools used in grafting are a light, sharp, small-toothed saw, to cut the branches, a sharp chisel to smooth the surface, a broad, stout-bladed knife to split the stock, a light mallet or hammer to drive the blade in making a cleft in the wood, a pot of grafting wax, and a ball of strips of narrow cloth to bind around the stock after the scions or buds are inserted.

**Benefits Derived from Grafting and Budding.** — The benefits derived from grafting and budding may be briefly summed up as follows: By this means the valuable kinds of fruits that are not easily raised from seeds or cuttings, may be rapidly propagated; hence, new varieties, when obtained, may be quickly introduced to all sections suited to their growth. By this means, also, a comparatively worthless tree may be made to produce the choicest variety of fruits in from two to four years. By grafting several varieties of fruit on the same tree, a succession of from early to late fruits may be obtained in a small garden, and from few trees. Certain tender and delicate varieties may be made more hardy by grafting them on to robust stock, and also to grow in a climate not naturally adapted to them. Grafting also hastens the bearing of seedling varieties of fruit which would be a long time in arriving to a full-grown, bearing tree; hence, a seedling pear or apple that might require from twelve to eighteen years to arrive at the bearing period, may by grafting it on to the extremity of the branch of a mature tree, produce fruit in from three to four years. Dwarf fruit trees may be obtained, when desired, by grafting certain kinds of fruit on suitable trees of slow growth.

**Selecting Scions.** — Repeated experiments have demonstrated the fact that in nearly all kinds of grafting by scions the highest success is attained when the tree upon which the scion is grafted is a little more advanced than the scion itself; therefore, in order to have the sap of the tree to be grafted in a more active state than the scion, the latter is generally cut

some time before being used, such as very early in the spring, during the winter, or even in the autumn. As soon as cut, they should be put in a dark, damp place, to prevent drying. The best method is to bury the lower ends in the ground in a dark part of the cellar, or cover them entirely with fine soil in the cellar until wanted for use. Some recommend that they be cut in the fall, when the leaves are fallen and wood is ripe, and be preserved through the winter by burying them in the earth in a dry soil, below the reach of the frost. In cutting the scions for use, the most thrifty and straight shoots of the previous season's growth should generally be selected, although it is claimed by many that there are special advantages to be derived from using wood of two seasons' growth. Each scion should contain at least two buds when subdivided, but they should not be subdivided until ready for use, as they will remain in a more thrifty condition if left entire until that time. In cutting, an inch and a half or two inches of wood should be left above the last buds, to prevent them from drying up by the shrinking of the wood. Never select scions, however vigorous they may seem, from a sickly and unhealthy looking tree or branch, as such will be very likely to develop an unhealthy condition in their future growth. In selecting from old trees, always choose the most vigorous of the last season's growth that are found near the center or top of the tree, since these will be apt to have more natural vigor than those growing from the side branches. Those taken from the lower bearing branches are thought by many to produce fruit soonest, but they will not prove as vigorous or thrifty as those from the center or top of the tree, neither will they produce trees of so fine a form as the latter. When practicable, choose the scions from young. thrifty trees in preference to old trees, however vigorous they may seem. Care in selecting good scions will well repay by the after-vigor and healthfulness of the trees.

**The Kind of Stock for Grafting Upon.**—Although scions or buds of different kinds can be made to grow upon a variety of other trees, yet they will thrive best and prove most productive when grafted upon those for which they have an affinity, and to which they are allied. There should therefore be a relationship between the stock and the scion, the structure of the wood being similar, such as the varieties of the same species, as the different kinds of apples grafted upon each other; next removed from this would be the grafting of the different species of a genus, as the apple and the pear, in which case there will be a growth, but not as complete and permanent as with those of the same species. Farther removed still would be a union of the genera of the same natural family, such as the cherry and the plum, which scarcely ever survives the third season. Apples are usually grafted on to apple or crab seedlings for standards, or dwarf stock for dwarfs; such as the Paradise apple. or Doucain's pears on pear seedlings for common culture, or quince for dwarfs; peaches on those of their own kind; apricots on apricot seedlings or plum; nectarines on the peach or plum, etc. Trees to be grafted should have been standing at least a year, as newly transplanted trees will not give as good results. Trees to be grafted should always be thrifty and vigorous.

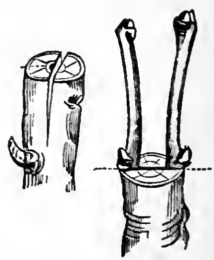
**The Best Time for Grafting.**—The proper time for grafting fruit trees is in the spring, as soon as the sap commences circulating. This varies with different varieties, being much earlier with the cherry and plum than with the apple and pear. The time also varies, of course, with the season and climate, but is generally from February to the middle or last of April. The most favorable weather for grafting is a mild temperature, with occasional showers, which prevent the drying up of the scion before a sufficient union takes place between the woody parts to enable the latter to be nourished by the sap of the tree into which it is grafted. Root grafting is frequently practiced in the house in winter or early spring, the roots afterwards being placed carefully in a damp cellar until the time of planting them out in the spring. This method, however, is only when the root is small, and the whole of it is devoted to supplying nourishment to the graft.

**Methods of Grafting.**—The science of grafting is based upon the ability to produce a union between the tissues or forming matter of the growing wood. In order to accomplish this, the parts should be placed in perfect contact, so that the sap of the stalk, in ascending, passes directly into the scion, thus sustaining its life. The buds of the latter, being thus stimulated, begin to put out, woody fibers are formed between the parts in contact, which eventually unite the graft firmly to the stalk. De Candolle says in relation to this union: "If the descending sap has only an incomplete analogy with the wants of the stock, the latter does not thrive, though the organic union may have taken place; and if the analogy between the albumen of stock and scion is wanting, the organic union does not operate, the scion cannot absorb the sap of the stock, and the graft fails." There are various methods of grafting, among the principal of which are whip or tongue, cleft grafting, splice grafting, saddle grafting, side grafting, root grafting, budding, etc.


WHIP OR TONGUE GRAFTING.

**Whip or Tongue Grafting.**—This is one of the most common methods of grafting, and is very easily performed. The scion and branch to be grafted are first cut in a sloping manner, upward on the stock, and downward on the scion, being made to correspond so that when placed together the bark of the two joins evenly. The knife is then passed upward in the scion, and downward in the stock, forming a sliced-tongue appearance, as represented in the cut, the incision serving to hold the scion in place when properly placed. They are then bound together with a narrow strip of cloth (about half an inch), which is wound tightly around the stock, while the whole is finished by covering with a coat of grafting wax (about half an inch thick), extending it fully an inch above and below the wound. This excludes the air and moisture, and prevents drying and loss of sap where the wound has been made. There are other methods of whip grafting; for instance, where the scion does not correspond in size with the stock, when the former is joined at the side or at the end of the stock, according to the comparative size of the two.

**Cleft Grafting.**—This method of grafting is frequently practiced on large stocks, or trees, the branches of which are too large for whip grafting. The stock to be grafted is first sawed off horizontally, and made smooth with a knife or sharp chisel. A cleft is then made in the stock about two inches deep. This may be done with a splitting knife and hammer or wooden mallet. The scions are then cut at the lower end in the form of a wedge, the wedge being made about an inch and a half long, leaving it a little thicker on the outer edge, and so trimmed that the bud is left on the outside and close to the junction of the stock and graft. The scion should also be left two or three inches beyond the bud, to prevent the latter from withering by the drying up of the wood. The cleft is then opened with a small chisel or splitting knife, and the scions carefully inserted at each end of the cleft, when the stock is large, fitting the inner bark of the scion to that of the stock. As the chisel is withdrawn, the scions are held firmly in place. After being thus set, the end of the limb and sides of the cleft should be well covered with grafting wax, and the whole bound up. The point to be gained in cleft grafting, as well as all other methods, is to have the inner bark of the scion exactly meet the inner bark of the branch upon which it is grafted, for unless a perfect fit is made the sap of the stock will not nourish the graft, and consequently it will soon shrink and die.


CLEFT GRAFTING.

**Splice Grafting.** — With this method of grafting it is essential that the branch to be grafted correspond precisely with that of the scion, so that the two pieces of wood perfectly fit the bark, joining evenly. There should be a smooth, sloping cut made upward on the stalk, and downward on the scion. When laid, the one upon the other, and the inner bark of the one corresponds exactly with that of the other, bind them firmly together with a flat strand that will not cut into the bark, and cover the wound entirely with grafting wax, extending the covering of wax fully an inch above and below the place of joining. The two form a union quite readily when skillfully performed, leaving scarcely any wound to heal.

**Saddle Grafting.** — In saddle grafting, the end of the stock is cut into the form of a tapering wedge, and the end of the scion cut upward to fit it perfectly, so that the inner bark of the one may fit that of the other. The wound is then wound with strips or bands, and the whole covered with grafting wax, as in methods previously described. This mode offers the largest surface for the junction of the scion and stock, and is generally attended with success where other methods have failed.

**Side Grafting.** — Side grafting has been attended with excellent results in the magnolia and other trees difficult of propagation; also where the grafting has been delayed until quite late in the spring. It consists of cutting a slit from one to two inches in length in the bark at the side of the stock, and cutting the scion in the form of a slender wedge, so paring it that in inserting there will be a union of the bark and wood, leaving the top of the branch to maintain the circulation of the sap until the graft has become well united, when the stock should be cut away.

**Root Grafting** is a mode sometimes practiced where the object is to increase the variety rapidly, or where other means of propagation are not available. In such cases the scion is grafted directly upon a portion of the root of some suitable stock, the latter being of sufficient size to furnish nourishment to the scion, although the best results are generally attained when both scion and root are rather small. The tops of the roots to be grafted should be cut down close to the crown; then cut the roots into pieces from four to eight inches long. The scions are then cut into pieces three to four inches in length. The scion and the root should be as near the same size as possible where they join, so that the bark will come together on both sides. The fitting of the surfaces to be joined may be according to whip or tongue grafting, splice grafting, or saddle grafting, as previously described. Grafting paper may be made by melting together one pound of rosin, one-half pound of beeswax, and one-half pound of tallow, which, when well melted and mixed, spread while hot upon one side of a newspaper with a brush, and when cold cut the waxed paper up into strips half an inch wide. Wind a strip of this waxed paper around where the root and scion joins to hold them in place, and insert them in a pot of fine, moist soil, being sure to press the root and scion firmly together, and have them held tightly in place. If the waxed paper does not stick well at first, place it in the warm sun or near a fire, but not sufficiently near to melt the wax. They will need to be handled carefully, not to be misplaced. If the buds of the root and scion do not match on both sides, which is the best way if possible, it is very essential that they should on one side. In covering with soil, all but the upper buds of the scion should be covered, so that the lower ones or the wound may not be exposed to the atmosphere. When grown together, they can be transplanted whenever desired. Root grafting may be done in winter, and the grafts properly labeled, packed away until the time of setting in the spring, in boxes in fine soil, or sand and sawdust, putting the boxes in a cool, damp place in the cellar, where they will not freeze or commence to grow. They should be examined occasionally, and if the buds show any signs of shriveling moisten slightly with water. New varieties of grapes may be grafted upon the roots of wild grapes or the common

sorts in this manner, always being sure to leave at least three buds on the scion, and when set in the ground having two eyes well covered with the soil. The two principal points to bear in mind in this mode of grafting are to press the surfaces to be joined closely together, so that a union can be easily effected, and to set the scions deep in the soil. Dahlias and peonies may be grafted upon each other, by inserting young shoots into the neck of one of the fleshy roots of each kind respectively, the cut for the insertion being triangular in shape and made at the upper end of the root. It should be just large enough to admit the young shoot, when cut at the end in a wedge shape, to fit the incision.

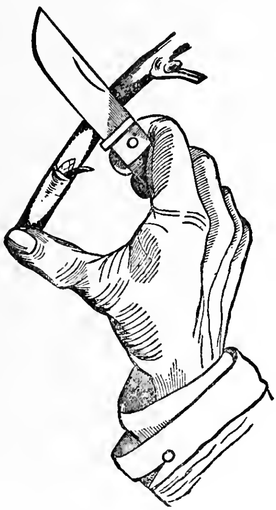
**Grafting Wax.**—The best kind of grafting wax is made of equal parts of tallow, beeswax, and resin melted together. Its quality is greatly improved by thoroughly working it with the hands when cold. A little more tallow than the other ingredients will render it more pliable, if desired. Some prefer a larger proportion of resin than the above named. This wax may be applied directly to the graft, or it may be spread with a brush when in a melted state, upon cloth or paper, which may be afterwards cut into suitable strips for wrapping around the wound. Grafting clay is sometimes used in place of grafting wax, but the latter affords a much better protection, besides being neater, and is greatly to be preferred. Liquid grafting wax may be made ready for use and kept in a bottle for years, by heating one pound of resin slowly, and adding one ounce of beef tallow; when a little cooler, stir in a tablespoonful of spirits of turpentine, and then add seven ounces of alcohol while still warm. Should it become thickened by keeping, it may be thinned by warming slowly, and adding more alcohol

**Budding.**—Although a different process from the modes of grafting previously described, budding does not differ from either in its nature or effects, the principal difference being that in grafting we use a scion having several buds, together with a quantity of bark and wood, while in budding but a single bud is used, to which a small quantity of bark and wood are attached. The advantages of budding. compared with those of grafting, consist in the rapidity with which the former may be performed; the more convenient season for doing it, since it can be delayed beyond the hurry of spring work in the nursery or on the farm; of its being done without injury to the branch; and the opportunity of repeating it on the same stock if the first effort proves ineffectual. The season for budding trees in this country is in the summer, from the first of July to the middle of September, the earlier trees requiring it sooner than those that open their leaf and blossom-buds later. Budding may also be done in the spring. In all cases the bark must separate easily from the stocks that are to be budded, so that it may be lifted without injury. The principal methods of propagating by this means are shield and annular budding.

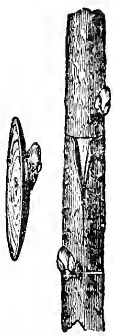
**Selecting Buds.**—It is highly important that the buds for budding trees be taken from healthy, vigorous shoots, and well developed. Mr. Downing says: "In choosing your buds, select thrifty shoots that have nearly done growing, and prepare what is called a *stick of buds,* but cutting off a few of the imperfect buds at the lower, and such as may be yet too soft at the upper ends, leaving only smooth, well-developed single buds; double buds being fruit-buds. Great care is essential in selecting buds, as often, even on sticks cut from young trees, and especially from bearing trees, many of the single buds will be found developed into fruit-buds, and are therefore unfitted for use. The form of a wood-bud is always long rather than round, and, in the case of peaches, there are sometimes triple buds, the centre one of which is always a wood-bud. Cut off the leaves, allowing about half an inch of the foot stalks to remain for conveniently inserting the buds."

**Shield Budding.**—With this method, an incision is made in the stock from an inch to an inch and a half in length, and at the top of this a cross is made, the whole forming the letter T. The north side of the stock is usually taken for this purpose, when convenient,

as it is less exposed to the sun. Select a bud from the scion, and with a sharp budding knife, cut a thin, smooth slice of wood and bark containing the bud. Raise the bark on each side of the incision of the stock carefully, just wide enough to admit the bud, and slip the prepared bud gently under to the bottom of the incision. If the upper portion of the bark of the bud projects above the horizontal incision, it should be cut off so as to fit the place completely. Strips of cloth, woolen yarn, and other soft material should next be tied over the wound firmly so as to hold the bud in its place, pressing the bark close to the wood, and leaving the bud only exposed to the light. In two weeks after the operation the bud will look plump and fresh if alive; the bandage may then be loosened, and if the branch has swelled much, it may be removed altogether. If on the other hand the bud has failed, it will look shriveled, and if the bark parts readily another trial may be made. When budding is performed late in the summer it may be well to leave the bandage as a protection during the winter.



CUTTING A BUD.



PREPARED STOCK AND BUD.

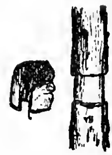
As soon as the buds commence swelling in the following spring, the branch budded should be headed down with a sloping back cut within two or three inches of the bud. This will cause the bud to make a vigorous start, as it will then be nourished with a larger amount of sap than otherwise. The shoots near the bud should be removed also, that they may not rob the bud of the nourishment it should receive from the stock. It is a good plan to tie the buds with two distinct bandages, one above the bud and another below. In this case the lower bandage may be removed as soon as the bud has taken, the upper one remaining some time longer, and by its pressure arrest the sap flowing upward in the branch, contributing to the growth of the bud.

The conditions essential to success in budding may be briefly summarized as follows: 1.—The buds must be from healthy, vigorous stocks, and perfectly developed in the axils of the leaves on the young shoots from which they are taken, and the wood must be well matured and ripe. When the wood is not sufficiently matured, it can be made so in the course of a

week or two by pinching the tips of the shoots and thus arresting their growth. 2.—The bark must separate easily from the stocks to be budded so as to be lifted from the wood beneath it without injury. 3.—The bud with its slice of bark must be perfectly separated from the scion without injuring the eye or center of the bud where it is attached to the wood. 4.—The bark containing the bud, and the bark of the stock must be brought close together in order to secure the necessary healing of the wound, and the attachment of the bud to the stock. 5.—The wound must be protected by a bandage to exclude air and foreign moisture. Choice varieties of roses and other plants may be propagated by budding, as well as fruit and other trees.

*Reversed Shield Budding* is simply making the horizontal cut at the bottom of the incision of the bark instead of at the top, and does not seem to possess any advantage over the former.

**Annular or Ring Budding** is frequently practiced with trees of hard wood and thick bark, or that have buds of such large size that shield budding would be a difficult operation. By this mode, a ring of bark is taken from the stock, and a ring of corresponding size containing a bud is taken from the scion and inserted in place of the former; in cutting the ring, care should be used not to cut too near the bud, but to leave sufficient space above and below it,—perhaps from an eighth to a quarter of an inch,—to protect it. If the ring from the scion should be too large around or too small, it may be cut to fit the stock by shortening it, or be pieced out by a strip of bark added. Bandages should be applied the same as with previously described modes.



ANNULAR BUDDING.

**Propagation by Cuttings.**—This mode of propagating fruit trees consists of planting scions in the ground, by which means they take root at the extremity, thus becoming a new and perfect plant. All fruit trees and vines may be propagated in this way, but some will grow much more rapidly than others, a few only growing sufficiently fast in this way to render their propagation by this means desirable. Those that may be the most successfully propagated in this way are the currant, gooseberry, grape vine, quince, fig, and mulberry. Cuttings of the currant, gooseberry, and hardy kinds of grapes will take root very readily in the open garden in a soil that is not too dry.

One of the best authorities on this subject gives the following directions: "Currants and gooseberries are generally taken off in the fall or winter, prepared for planting, and two-thirds of their lower ends buried in the ground till the commencement of spring, when they are planted out, either where they are to remain or in nursery rows. They will succeed nearly as well if taken off in the spring, but, owing to the period at which they commence growing, this must be attended to *very early*, if deferred till that season. A successful practice is to prepare the cuttings of gooseberries and currants early in the autumn, and to plant them at once in the position where they are to grow the succeeding summer. In planting, set the cuttings into the ground so deeply that but one bud will be left at or near the surface, and then, as soon as the frosts of winter come, cover the whole ground with a light mulch of straw manure, or other litter three or four inches deep.

In order to raise plants of the gooseberry and currant, with straight clean stems, which shall not throw up suckers, it is only necessary, before planting the cutting, to cut out every eye or bud to be placed below the surface of the ground. The cutting should be about a foot long, eight inches of which may be inserted in the ground. To insure a greater success in raising the finer sorts of gooseberry, or other shrubs, it is customary to plant the cuttings on the shaded side of a wall or fence, in deep rich loam, rather damp than dry. Cuttings of the vine are generally prepared when trimming the old plants in autumn or

winter; they may then be buried with their lower ends in the ground, or kept in earth in the cellar till spring. Grape cuttings are also made as soon as it will answer to prune the vines in the autumn; and being planted at once in the ground, covered as above noted for gooseberries and currants, are found to grow successfully.

Scarce sorts of grapes, which it is desirable to multiply extensively, are frequently propagated by joints: that is, by buds having about two inches of wood attached to each—every bud in this way forming a plant. When this mode is adopted, it is usual to plant the joints about half an inch deep, in light soil, in a common hot-bed prepared for the purpose, or each joint is planted in a pot by itself. In the first way a greater number of plants may be grown in a small space. As a general rule, cuttings succeed best when they are taken off just between the young and the previous year's wood; or, in the case of young side shoots, when they are cut off close to the branch preserving the *collar* of the shoot. The lower end should be cut smoothly across just below a bud, the soil should in all cases be pressed firmly about the lower end of the cutting, and it should always be planted before the buds commence swelling, that the wound may in some measure heal before growth and the absorption of fluid commences."

**Propagating by Layers and Suckers.**—A layer is a branch or vine not separated from the plant, which is bent down and covered with soil for the purpose of having it take root, and thus the variety be propagated. There are many kinds of plants that do not grow readily from seed, or take root from cuttings well, that can be readily rooted in this way. Raspberries, blackberries, and many varieties of grape vines are more easily propagated by this means than any other; there are also many kinds of fruit trees that may be treated in the same manner. Fruit trees are usually layered in the spring, the layers becoming well rooted by autumn, when they may be taken off if desired; but they may also be layered with good success as late as the early part of July.

When raspberries, blackberries, and similar plants are to be layered, it should not be done until the tips of the plants grow nearly free from leaves, and are of a dark, purplish color, which will be in August or September. In making layers, the ground around the parent plant should be made mellow with a spade. Then bend down a branch so that it will lie upon the ground, and make a little trench three or four inches deep to receive it, cover with soil and press it down, keep the end of the branch a few inches above the ground. Some kinds of plants that are layered will take root much more easily by making a slanting cut half way through the upper or under side of the shoot before covering it with soil, since the descending sap in the branch is somewhat arrested at this point, and causes little fibres and rootlets to put out rapidly. Ringing, twisting, or slightly wounding a limb answers a similar purpose, although not as well. Fastening the branch down with a hooked peg before covering with soil helps to hold the branch in place more securely.

**Thinning Fruit.**—It is too frequently the custom with farmers, after setting out fruit trees, to leave them to care for themselves; they are therefore left to live or die, without pruning, culture, or care of any kind. The result of this treatment is that of those trees that survive many become diseased from the attacks of insect enemies, their growth is retarded, while the fruit will be of poorer quality and less abundant than if proper care were given. The trees are allowed to overbear, being heavily laden with fruit one year, with little or no fruit the next, the vital forces of the trees being so excessively stimulated by the growth and ripening of the fruit during the bearing season, as to require a rest the following year to recuperate. Besides the failure of the fruit crop the following year from overbearing, this over-production involves another difficulty; exhaustion follows, and the wood that is formed during the season does not become fully matured or ripened, and is consequently frozen during the winter; hence there are few blossoms that are put out the following spring. When

left constantly to themselves this habit of bearing every alternate year becomes permanent; consequently there will be an excess of fruit one season, and a scarcity the next.

The remedy to be found for this difficulty is in thinning the fruit as soon as it is fully set, or at least, very early in the season, before the tree has expended much of its vitality in the nourishment and growth of the young fruit. If delayed too long, these energies will all be wasted, and but little good will be accomplished. Some fruit-growers clip off the blossoms or small fruit with pruning shears. The experiment of beating off the blossoms with a long pole has been thoroughly tested, and is not satisfactory, since this is liable to injure permanently the bearing twigs. The most satisfactory method of thinning fruit, both as to results and labor involved, is to pick off the fruit by hand as soon as set, dropping it upon the ground. Considerable labor will of course be involved by any method of thinning, but the good results that follow fully compensate for it, especially with the choicest varieties of the orchard.

By thinning fruit in this manner, trees may not only be made to bear every year, and the evils of overbearing obviated, but fruit thus grown will be of better quality, larger, and more perfect in form than when the trees are left to themselves. Good sized and perfectly formed fruit will bring a much better price in the market than two or three times the same quantity of imperfect fruit. For further information on this subject we refer the reader to methods recommended for CHANGING THE BEARING YEAR.

**Gathering and Assorting Fruit.**—Like all other crops produced upon the farm, (which require harvesting in a proper manner and at a suitable time), the value of fruit will depend much upon the care it receives at the time of gathering. Many farmers cultivate fruit of good quality who are not able to keep it through the winter, simply from carelessness in gathering, or from its not being gathered at the proper time. Fruit that is gathered before being properly ripened, or so late that it has become affected by the frost, or that is bruised or imperfectly sorted, will neither keep well or command the best market price, however well it may have been cultivated. A large amount of fine fruit is lost yearly by carelessness at the time of harvesting, and storing in unsuitable places.

The time of picking fruit of course varies with different varieties and the purpose to which it is to be appropriated. A large amount of early fruit found in the markets is picked while so green that its flavor and quality are greatly impaired. Most fruits that are transported from a great distance must of necessity be gathered before becoming fully ripe in order to bear transportation. Oranges, for instance, that are found in the Northern markets are very different in flavor from those that have been permitted to ripen on the tree. The same may be said of apples, peaches, and many other kinds of fruit. Pears, however, are an exception to the general rule, and are much more juicy and fine flavored when picked before being mellow. Winter fruit, whether for market or family use, should be picked when quite hard, but apples of the early varieties should be allowed to become mellow on the trees, unless they are to be transported a long distance.

Early ripening apples that are picked when sufficiently hard to bear a safe transportation to a distant market, could hardly be recognized as the same variety as those that have been permitted to ripen on the tree. All kinds of late ripening fruit should be gathered before the appearance of severe frost, for fruit that has become frost-bitten in the least will decay in a short time; however, the gathering should be delayed as long as possible with safety from frosts, as it will be better under such circumstances. Winter pears will, however, endure a greater degree of cold than apples with safety, but they should not be exposed to a hard frost. Choice fruit of all kinds should be picked by hand, and never shaken from the tree, since any bruises, however slight, will soon cause fermentation to set in, followed by premature decay.

Fruit should be gathered in dry weather, or, if gathered when wet, it should be allowed

to dry before being stored for winter use, or packed for market. Even when picked by hand, it should be handled with care, and never be *thrown* into the basket or sack for receiving it, but carefully laid down, for if dropped only a few inches upon other fruit, it will be more or less bruised. Such bruises may be so slight as to escape notice, but they will be sufficient to cause premature decay. In removing from the sack or basket in which it has been put when picked, the same care should be observed with all fruit that is designed for long keeping, or that may be easily bruised. Never turn it out of a basket or sack into a barrel, for by so doing, each specimen will become more or less injured. It is well to spread apples or winter pears for a few days or weeks in some cool, dry, suitable place, such as the floor of a store room or barn, before they are put away for winter use, since a moisture will gather upon them for several days, which, unless dried off, will cause premature decay. This gathering of moisture is called the "sweating" process.

An opportunity is thus afforded, also, for carefully selecting and grading the fruit before storing for winter. Unless properly assorted before marketing or storing, imperfect specimens will be mixed with the sound fruit, and by their decay will soon cause the latter, with which they come in contact, to decay also. In packing fruit, such as apples, pears, or peaches, in crates or barrels for market, the latter should be gently shaken occasionally while being filled, so as to fill up all the vacant spaces possible, and prevent bruising by being shaken about in transportation. When closely packed, so that it cannot move about, fruit may be transported any required distance without injury from bruises.

**Storing Fruit.**—Before storing, fruit should be properly assorted, and all imperfect specimens separated from those that are fair and sound. The large and small should also be put in separate barrels, whether for storage or market. Care should also be taken that the fruit, before storage, is perfectly dry; since moisture, whether from dew, rain, or the natural sweating process, is not favorable to the keeping qualities of fruits of any kind. Some fruit-growers in packing winter fruit for storage, take especial pains to wipe each specimen with a soft cloth to remove all moisture before putting it in bins or barrels. Others, in storing choice winter fruit, wrap each apple or pear in a piece of paper, that it may not come in contact with others. Some consider a layer of fine cut straw between the layers of apples in barrels or bins, as tending to promote their keeping qualities. Better than either is to arrange fruit, such as winter pears or apples, on the shelves of a fruit room or hanging racks, where they will not come in contact with each other, but be constantly surrounded by a dry, cool atmosphere. Packing in plaster is a very good means of preserving fruit. A recent writer gives the result of his experiments as follows:

"I have been experimenting the past few years with apples, and find those packed in plaster keep much longer than any other way I have tried. I use flour barrels, and find them preferable to apple barrels, as they are made tighter. I first cover the bottom of the barrel with plaster, then a layer of apples, then cover with plaster, and so on till the barrel is full; then put the head in and drive the hoops tight. The plaster, being of a cold nature, keeps the fruit at an even temperature, and being fine and dry, packs so close as to keep the apples air-tight. I had Northern Spy and Swaar almost as fresh in May as when picked, and found no decayed one, and think they would have kept till early apples were ripe, had we not used them. Shall put up several barrels for next spring and summer use, as I am satisfied that our best varieties, such as Steel's Red Winter, Wagener, and Seek-no-further, will keep several months longer than by putting them up without plaster, and will retain their flavor much better beside."

The rule for storing all fruit is to keep it dry and as cool as possible without freezing; also at an even temperature. A damp cellar is a very unsuitable place for fruit; none, however good, can long be kept sound in such a place,—a cool and dry atmosphere being absolutely essential to its preservation.

**Fruit Rooms.**—A fruit room constructed in connection with an ice house, so as to be kept cool by means of the latter, is an excellent place for the storage of fruit. The best we have seen of this kind was constructed inside a large ice house, so arranged that ice was stored on the sides and overhead, while ample means were provided for drainage below by the use of pipes underneath the floor, and a condensing tube inside the fruit room. By this method the temperature could be kept at all seasons just above the freezing point.

Preserving fruit on a large scale in this manner would of course involve considerable expense and care, which would be beyond the means of most farmers and fruit growers: Mr. R. H. Haines, whose opinion on subjects pertaining to fruit we have had previous occasion to quote, gives the following directions respecting the construction of an inexpensive fruit house: "If under the house, it is well to have the ceiling plastered to prevent unhealthy effects from decaying fruit. If under the barn or stables, or in them, then all unpleasant odors should be kept away from the fruit. They should always be arranged so as to let in cool air when desired. If convenient, it is better to have apples kept in a separate apartment, but not necessary. Sometimes a small building can be cheaply made into fruit rooms, by filling in the siding with sawdust, or spent tan-bark. If erecting a building on purpose, then the walls and ceiling should be double, using tongued and grooved boards inside and out, and filling in with six inches in width of sawdust, etc. If good drainage can be obtained, it is better to heap up the earth high around the outside. The floor may be either of boards, gravel, or cement. The building should have double windows and doors, so as to be kept warm in winter, and cool in summer.

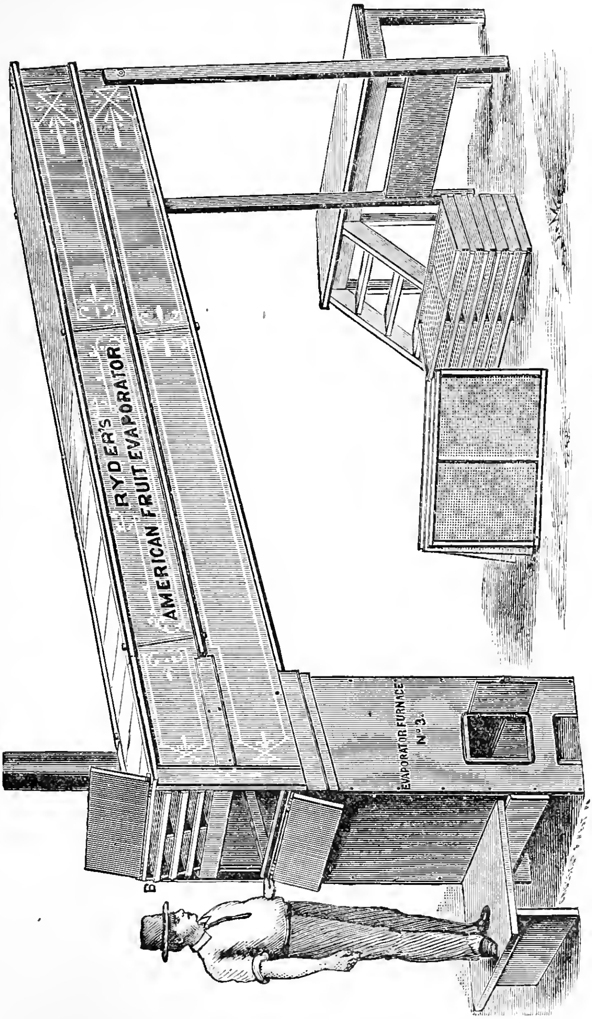
Another method is to have the fruit house in the side of a hill, making the walls of brick or stone, and having a double roof, packed between with one or two feet of salt hay or sawdust. It is well to have the roof reach pretty near the ground. Even a small house, ten or twelve feet square inside, and eight feet high, will hold a large amount of fruit, and when kept cool inside will keep early apples or pears until winter, and winter apples for a year or more. When properly made and regulated, a fruit house will add greatly to the enjoyment to be obtained from fruits."

**Drying Fruit.**—In fruit growing sections, it has long been the custom to dry a portion of the fruit product in order to preserve it from decay for future use. Thus apples, peaches, pears, currants, berries of various kinds, etc., have been dried and preserved for almost any desired length of time; but the old-fashioned method of drying possessed many objections, since it involved a vast amount of labor, and too frequently the quality and flavor of the fruit was greatly injured by the process, which sometimes required several days to complete.

The net-work of suspended apple and pumpkin that slowly dried in the unwholesome drafts of our ancestors' chimneys, or the compound of decomposed fruit, insects, and dust, that after a fortnight's exposure to the sun, rain, and dew on the roof or fence, or the rattling, partially charred product of the oven which represented American dried fruits, are fast being abandoned, and no longer furnish our markets as the representatives of our fruit-drying industry. A better method has been devised, which is destined to supersede the former, since it preserves the flavor of the fruit without impairing its quality, while the drying process requires but a very short time.

This process is by evaporating the moisture of the fruit quickly by currents of dry, hot air, without cooking it in the least, or changing its flavor; thus apples, peaches, pears, plums, cherries, berries, etc., when dried in this manner and afterwards soaked in water to regain their former plumpness, when cooked, can scarcely be distinguished (if distinguished at all) from the food manufactured from fresh, ripe fruit. Numerous fruit-evaporating machines are in use, which have not only greatly lessened the labor and improved the quality of dried fruits,

but have contributed largely to the fruit drying industry of the country. The following represents a machine of this kind manufactured by the American Fruit Drier Manufacturing Co., Chambersburg, Pa. They are made of all sizes, suitable to extensive fruit drying establishments, or for family use.




FRUIT EVAPORATOR.

With these machines, the moisture is soon removed without overheating or breaking the cell structure of the fruit, while there is no partial fermentation, as there is always when fruit

is dried in the sun. The fine flavor of the fruit is retained, and as nothing but water is removed, the addition of water restores the fruit to its original condition as far as any dried product may be restored to that condition for culinary purposes. The weight of a bushel of apples after being dried in a fruit drying evaporator, will be only from six and a half to seven pounds, and one hundred quarts of blackberries will weigh only about forty pounds. This is a very convenient method of preserving fruits that perish quickly, since when cured in this manner they can be packed away in jars, boxes, or paper bags where they may be safe from insects, and be kept any length of time until wanted for use, while during those seasons in which there may be a surplus of fruit, a quantity may be preserved in this manner and kept until a season of scarcity, when it will command a good price in market, or if preserved simply for home use, be very useful for household purposes.

**Protecting Fruit Trees and Vineyards from Frost.** — To retard the blossoming of fruit, and thus secure protection from frost, it is a good plan to heap up a body of snow and ice around the trunk and roots in cold weather, say February or March, or to mulch deeply when the ground is well frozen. This will have a tendency to retain the frost in the ground later, consequently the fruit buds are retarded in opening until past all danger from spring frosts. Another method of keeping off the frost, is to make a dense smoke near the trees or vineyard by making small fires and burning gas tar, straw, wood, etc., to prevent rapid radiation from the ground. Carriage sheets, light blankets, or paper are sometimes thrown over small trees and vines to protect them from frost, but this is scarcely practicable where there are many that require protecting.

## THE LARGER FRUITS.

**The Apple.** — Of all the different varieties of fruit grown in the temperate zone, the apple stands first in importance, being the most extensively cultivated of any, and embracing the most numerous varieties. From the most remote periods of antiquity, this fruit has been renowned, and ancient poets and writers speak of it as being endowed with superior virtues. There is probably no portion of the whole world in which the apple thrives so well, and attains such a degree of perfection, as in the northern and middle portion of the United States, the choicest apples of Germany and northern Europe scarcely equaling many varieties that have originated in this country. The source from whence all the different varieties of apples have originated, is a species of crab-apple growing wild in most portions of Europe. Although there are two or three varieties of the crab-apple growing wild in this country, these have not been used in propagating the apple here; it came from seeds of the species that were brought here by the European colonists.

The apple tree is very hardy, of slow growth, and long-lived. In its wild state, it is a very long-lived tree, but when cultivated the average period of life is from fifty to eighty years; by good care an apple orchard can be kept healthy and productive even much longer. It is, therefore, the best policy in planting an orchard to take pains in securing the best varieties suited to the section grown, and give the best of care. Although generally a tree of medium-sized growth, it sometimes attains enormous proportions. It is stated by the best authority that on the grounds of Mr. Hall, of Raynham, Rhode Island, are two apple trees that are more than one hundred and forty years old; the trunk of one fourteen years ago, measured at one foot from the ground, thirteen feet two inches in circumference, and the other, one foot less. These old trees bore fourteen years ago between thirty and forty bushels of apples; but in the year 1780 (when nearly forty years old), they together bore one hundred and one bushels of apples. An apple tree in Duxbury, Massachusetts, has been known to yield in a single season one hundred and twenty-one and a half bushels; this tree has a girth

of twelve feet and five inches. Another in Lehigh County, Pennsylvania, is said to measure seventeen and one-half feet in girth one foot above the ground, is fifty-four feet high, with branches extending thirty-six feet each way from the trunk. No fruit is more abundantly produced or generally liked than the apple, while it is exceedingly wholesome and nutritious. The slight care required for its culture also renders it valuable. The earliest varieties ripen towards the last of June, and the latest, when properly stored, can be preserved until that time, so that with suitable varieties and good care, it is a fruit that may be had during the entire year.

**Propagation.** — The usual mode of propagating apples is described by Mr. Downing as follows: "The apple for propagation is usually raised from seeds obtained from the pomace of the cider mills, and a preference is always given to that from thrifty young orchards. These are sown in autumn, in broad drills, in good mellow soil, and they remain in the seed beds — attention being paid to keeping the soil loose, and free from weeds — from one to three years, according to the richness of the soil. When the seedlings are a little more than a fourth of an inch in diameter, they should be taken up in the spring or autumn, their tap-roots shortened, and then placed in nursery rows, one foot apart, and three to four feet between the rows. If the plants are thrifty and the soil good, they may be budded the following autumn, within one or two inches of the ground, and this is the most speedy mode of obtaining strong, straight, thrifty plants. Grafting is generally performed when the stocks are about half an inch thick. When young trees are feeble in the nursery, it is usual to head them back two-thirds the length of the graft, when they are three or four feet high, to make them throw up a strong, vigorous shoot. Apple stocks for dwarfs are raised by layers.

Apple trees for transplanting to orchards should be at least two years budded, and six or seven feet high, and they should also have a proper balance of head or side branches."

**Soil, Site, etc., for Apple Orchards.** — Apple trees will thrive on a variety of soils, but will not do well on the two extremes, viz.: on very dry sands, or soils saturated with moisture. The soil that the apple seems to prefer most, and the one in which it attains its highest degree of excellence, is a rich loam of a calcareous or limestone character. It has been found that the best flavored fruit, the most abundant crops, and the longest lived trees are produced from a deep, rich, gravelly, marshy, or clayey loam, or a strong, sandy loam on a gravelly subsoil. Soils that are too damp may be rendered suitable for apple trees by thoroughly underdraining, and those that are too dry by deep subsoil plowing, where the subsoil is of a heavy or clayey nature.

The site chosen for an orchard should depend upon the climate. In the Northern States a southern or southeastern slope is to be preferred, thus securing the warmth of the sun to ripen the fruit and wood, while a protection from the cold northwesterly winds is thus partially afforded. In the Southern portions of the country, or where the climate is hot and dry, apple orchards will be found to flourish best on the northern slope, where the trees will be less exposed to the hot sun, and more moisture be derived from the soil. All young orchards should have the soil kept mellow and loose by cultivation, at least for a few years, until the trees become well established, and if the cultivation could be renewed every year during the life of the trees it would well repay for the labor. When the plow is used, the cultivation should be shallow, in order not to disturb the roots that lie near the surface. A disc or acme harrow is excellent for this purpose. For information respecting the transplanting, cultivation, and pruning of apple orchards, we refer the reader to general directions on this subject already given in connection with fruit culture.

**Varieties.** — There are at present about three thousand named varieties of the apple, while new ones are being constantly produced. Among the varieties most commonly pre-

ferred some thrive best in one locality and others in another, so that it would be impossible to name such as are best adapted to all sections. Indeed every State, and certain localities in every State, will generally be found to have special fine varieties peculiarly adapted to it, and which might not thrive equally well in other sections. It is the common mistake of farmers, in establishing market orchards, to plant too many ill-adapted varieties. Of whatever varieties chosen, it is better to have but a few of the choicest that are best adapted to the locality. The quality of any variety is largely modified by the soil and climate, and hence the necessity of obtaining those that are suited to the location. Some of the finest varieties known to the Northern States would be almost worthless when grown at the South, and a few kinds that succeed well at the North are of but little value in the Middle States. The farther south the apple tree is taken, the earlier it will ripen; hence the choicest kinds of winter apples grown at the North would not be of much value at the South. It would be impossible, in a work like this, to describe all of the leading varieties of apples of different localities; in fact, such a description would require quite a volume in itself. We will, therefore, mention some of the leading varieties adapted to the localities designated. For the *extreme* North, such as Northern New England and Canada, the most hardy varieties should be cultivated, such as, for summer fruit, the TETOFSKY, a large, yellow, tart apple that ripens in August; the LARGE EARLY BOUGH, a fruit above medium size, pale, greenish yellow in color, flesh white, sweet, sprightly flavor, which ripens from the middle of July to the second week of August; YELLOW TRANSPARENT, a good and productive kind for summer market; and DUCHESS OF OLDENBURGH, a sub-acid variety, of good quality, very hardy and prolific. Among the winter varieties adapted to the extreme Northern section are the WEALTHY, very hardy, sub-acid, tender, juicy, and with excellent keeping qualities; MAGOG RED STREAK, acid, good quality, hardy, thrifty, and an excellent bearer; SCOTT'S WINTER, an excellent keeping apple, being equal to the Roxbury Russet, and replaces it in very cold climates. It remains hard until April, and when properly stored will keep until July in a fresh, crisp condition. The MEANDER'S WINTER, TRANSCENDENT, LADY ELGIN, ALEXANDER, CLARK'S ORANGE, and SIBERIAN CRAB are also remarkably adapted to a cold climate, being very hardy; they are also each of good quality of fruit.

Among the varieties that are *nearly*, although not quite as hardy as the above-mentioned varieties, and are adapted to Northern sections, although not to the *extreme* cold climate, are the RED ASTRACHAN, a large, red, acid apple, ripening the last of August; SUMMER HARVEY, resembling the Rhode Island Greening in flavor and color, ripening the last of August; WILLIAM'S EARLY, of medium size, red, mild flavored, ripening the last of July to the first of September; FAMEUSE, RIBSTON PIPPIN, EARLY JOE, PRINGLE'S SWEET, PORTER, HOLDEN PIPPIN OR FALL ORANGE, MAIDEN'S BLUSH, and EARLY HARVEST, all of which are either summer or autumn ripening varieties; while the winter varieties of equal hardiness are the ST. LAWRENCE, BEN. DAVIS, NORTHERN SPY, JONATHAN, and TALLMAN SWEETING. For sections between the very extreme Northern and the Southern States numerous varieties are adapted, such as the BALDWIN, RHODE ISLAND GREENING, ROXBURY RUSSET, SEEK-NO-FURTHER, NORTHERN SPY, GREEN NEWTOWN PIPPIN, STEEL'S RED WINTER, GILLIFLOWER, SPITZENBURG, WAGENER, CANADA RED, WHITE WINTER PIPPIN, YELLOW BELLFLOWER, NONESUCH, PUMPKIN SWEET, GOLDEN SWEET, HUBBARDSTON, GRAVENSTEIN, FALL ORANGE, FALL PIPPIN, CANADA REINETTE, etc. The Roxbury Russet is one of the best keeping apples known.

The varieties that have been the most highly recommended for the Southern and Southwestern localities by leading authorities are the EARLY HARVEST, NEWTOWN PIPPIN, FALL PIPPIN, TETOFSKY, RED ASTRACHAN, GRAVENSTEIN, BELLFLOWER, SHOCKLEY, GOLDEN RUSSET, RED LIMBERTWIG, SMITH'S CIDER, RAWLE'S JANET, STEVENSON'S WINTER, ENSINGER'S NONESUCH, and SWEET RUSSET, etc.

Every farmer should have several of the best varieties of apples for home use that ripen

at different times, from the earliest ripening to the latest; but for market purposes a few of the choicest kinds suited to the section should be cultivated, it being borne in mind that a few choice varieties are much more profitable than a large number of different kinds. The farmer who plants an orchard of fifty or one hundred trees, representing from thirty to forty varieties, commits a grave mistake. He will not only fail of having a good market for his fruit, since a few of the choicest will be in the greatest demand and command the highest prices, but at the time of gathering the fruit, the different kinds will need to be kept separate, which will require considerable extra care and labor, while there will be but a few barrels of any one sort. There will always be a few standard varieties that will meet with a more ready sale than others. More than three-fourths of the apples shipped to Europe from the United States at the present time are Baldwins, which shows the great demand for this variety. For home market, the Rhode Island Greening and Roxbury Russet are about as popular as the Baldwin; but the Roxbury Russet is not generally as productive as the other two mentioned varieties, yet has better keeping qualities. Standard varieties, however, will always meet with a ready sale.

**Varieties of Crab Apples.** — The crab apples will thrive in almost any soil, and are exceedingly hardy. They are very tender; hence they can be cooked with the skins on, and are among the richest cooking apples known. It is a wonder to fruit growers that this profitable and hardy fruit is not more generally cultivated. The tree is very ornamental giving a profuse supply of beautifully shaded blossoms in spring, and in the autumn heavy clusters of richly colored fruit. The principal varieties are Aiken's Striped Winter, good quality, lasting from December to March; Hyslop, fruit large, deep crimson, ripens in October; Montreal Beauty, fruit very large and beautiful; Orange, one of the most popular varieties, and an excellent bearer; Transcendant, fruit very large, a very profitable variety; Van Wyck Sweet, a new *sweet* variety, skin yellow striped with red, large, and about the quality of the Tallman Sweet.

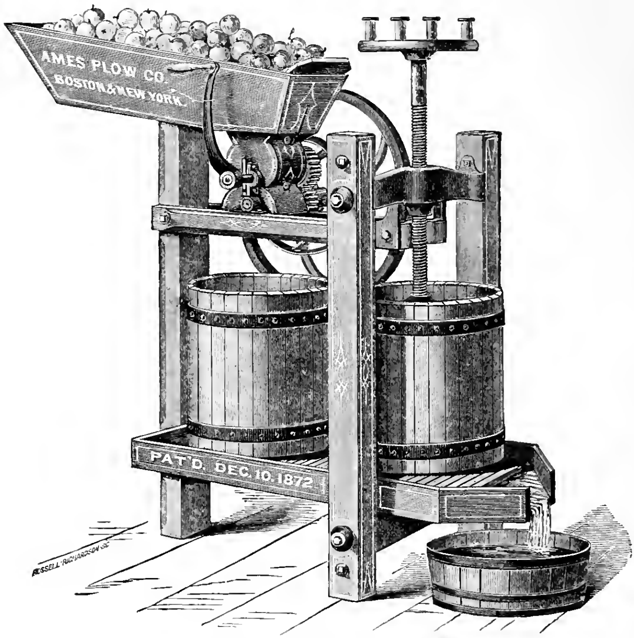
**Storing Apples.** — Suggestions concerning this subject will be found under the head of Storing Fruit.

**Cider Making.** — The method of manufacturing cider and the kind of apples used, make a vast difference with its quality. Cider that is the product of fruit which, besides being inferior, has perhaps been permitted to lie in piles upon the ground until half decayed, can neither be palatable nor healthful. Too many farmers are indifferent in this respect, and permit their cider apples to remain too long upon the trees, or lie through sunshine and rain in ponderous heaps upon the ground after being gathered, until half decayed, waiting for a convenient time to attend to the cider making. In fact, we remember, when a lad, of hearing an old Yankee remark, "I reckon that apples make a *leetle the best* cider, and a leetle more of it, that have a good many rotten ones mixed with 'em," an erroneous opinion prevalent in some localities, showing the perverted taste, as well as ignorance, of those who entertain such ideas. In order to make the best cider, good, sound, ripe fruit should be chosen, and the better the quality of the fruit, the better the cider. Nice winter apples, and such varieties as have rich juice and fine flavor, make excellent cider.

All apples will not make good cider, the early kinds and many of the fine dessert varieties being too juicy and watery to furnish a rich juice. The Roxbury Russet, Rhode Island Greening, Winter Pippin, Ben Davis, and Smith's Cider, are among the most popular varieties for this purpose. The addition of a few ripe quinces to the apples very much improves the flavor of cider, when a choice article is desired for bottling. All decayed, bruised, and wormy fruit should be rejected, and everything in its manufacture be perfectly clean. The fruit for cider should be gathered late in the season, or early in November, and care should be used in gathering to prevent the apples from being bruised when shaken from the trees.

To avoid this, before shaking the trees, it is well to lay coarse cloths or straw under them. After being gathered, the apples may lie in heaps upon the ground, or in sheds until perfectly ripened, but not sufficiently long to become decayed.

When ready for grinding, all the immature and rotten fruit should be rejected, and the remainder ground to a uniform mass. The pulp may remain with the juice in it a longer or shorter time, according as a lighter or darker color is required in the cider. The time




NATIONAL FARMER'S CIDER MILL.

for allowing it to stand in the vat varies from twenty-four to forty-eight hours, and sometimes even longer, if the weather is cool, the color being heightened and the saccharine principle being increased by a little delay. The liquid should be pressed out (without wetting the straw) and strained through hair-cloth or sieves, into clean, sound casks that are perfectly sweet. The casks should then be placed in a cool cellar. Fermentation will commence in a few hours; in order to permit this to continue, the bung should be left out, and as the froth and pomace work out of the opening, the cask should be filled every day with cider of the same pressing kept for this purpose. In two or three weeks, — according to the temperature, —this rising of pomace, which is the fruit fermentation, will cease. The bung may now be put in loosely for a day or two, after which it should be driven in tight. The cider will then be clear, and should be drawn off and put in a clean barrel or cask.

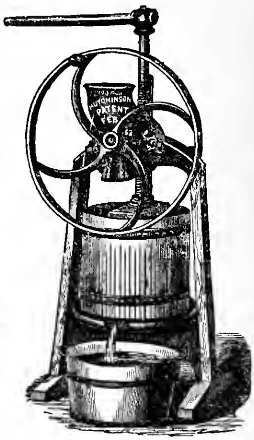
In this state, there is danger of the fermentation proceeding too far, and for this reason it should be watched. If it remains quiet, it may stand for some time before bottling, frequently until March or April. At this stage of fermentation, a gill of finely-pulverized char-

coal is sometimes added, or an ounce of isinglass, a half ounce of whole grains of white mustard, or a half pound of raisins to each barrel, to clarify and refine the cider; but this is unnecessary when well made of apples suited to the purpose.

**Bottling Cider.** — The old-time rule for bottling cider was early in the spring, or just before the apple trees blossomed. The time of bottling, however, will depend upon the condition of the cider, or rather the degree of fermentation to which it has attained, which latter, of course, will depend upon the temperature at which it has been kept. The usual time, if kept in a cool cellar, will be from three to four months after leaving the press. Good, strong bottles should be chosen, for if weak, they will be liable to be broken from the pressure caused by the fermentation. Fill the bottles within an inch of the bottom of the cork. Fasten the cork in firmly, and place the bottles with their necks downward, in a cool cellar, in clean, dry sand, or lay them on their sides in bins or boxes with layers of sand between each layer of bottles. A piece of rock candy about the size of a hickory nut, pulverized and put in each bottle, is thought by many to improve the quality of the cider. Three or four good sized raisins added to each bottle, will also serve the same purpose.

**Cider Wine.** — The following method of making cider wine is simple, and furnishes an excellent quality of this article. Take sweet and sour apples of equal quantity, using the best of sound fruit for the purpose. The addition of a few ripe quinces greatly improves the flavor. Grind in a mill, and allow the pomace to stand twenty-four hours, stirring occasionally, so as to expose it to the air. After expressing and straining the juice, add a pound and a half or two pounds of refined sugar to each gallon of cider, and put it in a clean barrel for fermentation, leaving the bung hole open, and filling up the cask each day with the juice to permit the froth and pomace to work off. As soon as fermentation ceases, draw off and put in a clean cask, and carefully exclude the air; in about four months draw off and bottle.

Cider wine made in this manner is nearly equal to the best champagne wine, which it closely resembles. A small family mill for grinding the apples will be found of great convenience in making cider or wine from grapes, currants, or other fruit. The Hutchinson Mill, of which we give an illustration, will grind from eight to ten bushels of apples, and from ten to twelve bushels of grapes or currants per hour. The press will contain one and a half bushels of apple pomace, while as small a quantity of cider as desired may be made in a few moments.



HUTCHINSON'S FAMILY MILL.

**Diseases and Enemies of the Apple.** — The principal diseases and enemies of the apple are the apple-borer, caterpillar, canker worm, bark louse, wooly aphis, apple worm, or codling moth, twig-girders, the blight, and the apple-bark beetle, while in many sections mice, rabbits, sheep, and cattle, do considerable injury to young trees unless properly protected from them. For treatment of these, see special department on DISEASES AND ENEMIES OF FRUIT.

**Pears.**—The pear may very justly be regarded as one of our best fruits in point of quality, and as a favorite fruit of modern times. In its wild state, the choke pear is anything but a palatable fruit, and its present improved and perfected standard is a wonderful proof of horticultural science and skill. The pear tree is not a native of this country, but was introduced here from Europe. It grows wild in hedges and wooded wastes in Europe, Western Asia, and China, in connection with the apple, and in the wild state is more hardy and longer lived than the latter; hence, the common impression that pear trees are tender, and that it is

difficult to obtain a good quality of this fruit, is altogether without foundation. Pear trees live to a great age under favoring conditions. M. Bosc, in his writings, refers to several which are known to be near 400 years old.

Other writers mention a remarkable pear tree in Herefordshire, England, which, in 1805, covered more than half an acre with its branches, which, bending down, would take root, and in turn produce others in the same manner. It is also stated that more than once, fifteen hogsheads of perry (the juice of the pear fermented) have been made from this tree in a single year. The delicious qualities of this fruit were not developed to any great extent until the seventeenth century, while during the last century more has been done to perfect this choice fruit than all the time of its cultivation previous, although it has been cultivated in Europe and Asia fully two thousand years.

Van Mons devoted almost his entire life to the improvement of the pear, he having produced 80,000 seedlings by his own individual efforts, from among which many valuable and choice varieties had their origin. Others have devoted much time and attention to hybridizing or crossing, and attained high success in this department, while new varieties are constantly being produced in this country through the efforts of enterprising horticulturists of the present time. With proper care, pears may be produced in abundance by any farmer who has a suitable soil, with but little labor or expense, while they are a luxury that no family should be deprived of. Pears will not keep as long as apples, but with suitably selected varieties, and proper storage, they may be had from August until the spring following, some of the winter varieties being very delicious, with good keeping qualities.

The principal value of the pear is as a dessert fruit, although it is used for baking, stewing, drying, canning, etc., to a considerable extent. Dessert pears should have a melting, soft texture, and should be juicy, sugary, and of an aromatic flavor. Pears for baking, drying, and canning should be large in size and be more firm in texture, with crisp flesh, and moderately juicy.

**Dwarfs and Standards.**—Dwarf pear trees are generally produced by budding or grafting on the quince. The principal object of this is to produce trees that will bear at a much earlier age than the standard trees, the dwarf frequently producing fruit in two years after planting. Such trees are frequently very fruitful, but are not usually very long-lived. They require the same treatment as standard trees, except that they should be planted from two to four inches deeper in the soil when being transplanted than they had previously grown.

They should be set so that the junction of the pear and quince should be about four inches below the surface of the soil, and the earth pressed closely and compactly around the trunk. With this method of setting, the pear-stem will frequently send out roots and sustain the tree after the quince root is dead. In such a case the tree becomes part dwarf and part standard, and will be longer-lived than otherwise.

Many varieties of pears succeed well as dwarfs, while others do not, and should never be grown in this manner. Some varieties do even better when grown as dwarfs than as standards. In planting trees it is always well to set a few dwarfs of each variety that succeed well in this manner, in order to supply fruit while the standards of the same, which are set at the same time, are attaining a bearing age.

Some of the principal varieties that succeed well as dwarfs are the Bartlett, Beurre d'Anjou, Duchesse d'Angoulême, Flemish Beauty, Vicar of Winkfield, Clapp's Favorite, Belle Lucrative, Buffum, Howell, Louise Bonne, and Louise Bonne de Jersey.

**Varieties.**—The varieties of pears are very numerous, and the number is constantly increasing by the propagation of new varieties in this country, and by importations from the old world. Among the hundreds of varieties, amounting to over a thousand, that have been originated, the great difficulty seems to be to determine which are the most valuable for cul-

tivation, and which are best adapted to certain localities, since a variety may prove of superior quality in one locality, and quite the reverse in another, the difference being caused by the difference in soil and climate. There are, however, many varieties that seem to thrive well in nearly all parts of the country. Mr. Downing says with reference to this subject:

"A variety may prove of superior merit in one locality and quite indifferent in another, owing to influence of soil and climate. This, however, is true only to a very limited extent, as the fact that most sorts of the first character receive nearly the same praise in Belgium, England, and all parts of this country clearly proves. High flavor, handsome appearance, productiveness, and uniformly good flavor in all seasons—these are the criterions of the first class of pears.

Most of the finer varieties of pears have not the necessary hardiness to enable them to resist, perfectly uninjured, the violent atmospheric changes of our climate, except under favorable circumstances; consequently the fruit is more or less variable in quality; and this is more particularly true of some that come to us from abroad with promise of the highest excellence, and to pronounce an abiding judgment upon their merits requires many years' experience and careful observation under different circumstances and in various localities. And it must be borne in mind that, although young trees give fruit of nearly or quite full size and beauty, yet perfection of flavor is only to be expected from trees of more mature age. The inference is not legitimate that a variety which exhibits great excellence in Belgium, or some of the districts of France, will exhibit generally in all localities in the United States the same excellence; but the supposition is fair, and borne out by some experience, that those which possess excellence of a particular character in an eminent degree in Europe, will generally exhibit the same in particular localities in this country. We would instance such vigorous growers, with pretty solid flesh, as the following: Belle Lucrative, Rostiezer, Duchesse d'Angoulême, Beurré Hardy, etc. To produce satisfactory results in the cultivation of pears, some of their wants must always be complied with, such as good depth of soil, sufficient drainage, and proper enrichment."

In some sections certain varieties are specially subject to disease, such as blight, yellows, etc., when in other localities they may be entirely exempt from disease of every kind, the climate, soil, etc., exercising a great influence in this respect. The amateur fruit grower will therefore do well to consult the best practical fruit growers in his vicinity with reference to the best adapted varieties, before selecting his trees, as he may thereby be saved much expense, labor, and disappointment.

It will not be possible, owing to want of space, to give in this work an extended list or description of the many excellent varieties of pears cultivated in this country; we shall only give a brief list of some of the choicest kinds, such as the BARTLETT, BEURRE D' ANJOU, DUCHESSE D' ANGOULEME, FLEMISH BEAUTY, BLOODGOOD, KEIFFER'S HYBRID, CLAPP'S FAVORITE, LOUISE BONNE, HOWELL, LAWRENCE, SECKEL, VICAR OF WINKFIELD, WINTER NELIS, BUFFUM, BEURRE CLAIRGEAU, BUERRE GIFFORD, BELLE LUCRATIVE, LOUISE BONNE DE JERSEY, BEURRE BOSC, LECONTE, ETC.

Among the varieties that will endure about the coldest localities of the United States may be mentioned the Flemish Beauty, Louise Bonne de Jersey (dwarf), Beurré d'Anjou, Clapp's Favorite, Doyennè d'Ete, Duchesse, Rostiezer, Seckel, Winter Nelis, and Onondaga, while the Bartlett and Lawrence are also quite hardy and able to endure a cold climate, although not quite equal in this respect to those previously mentioned.

**The Bartlett.**—This is the most popular of all the summer varieties, and originated in England in 1770, and was known there as Williams' Bonchretien. When first introduced its name was lost, and having been cultivated and disseminated by Enoch Bartlett, of Dorchester, near Boston, it became known by its present name. It is considered the best of all the summer varieties. The fruit is of large size, oblong, skin thin and smooth, clear yellow,

with a soft blush on the sunny side of the fruit that is exposed to the sunlight; flesh fine-grained, sweet and juicy, vinous. Ripens from the last of August to the last of September. The flavor is injured when grown in damp or unfavorable soils, it then being somewhat acid.

**Buerre d'Anjou** is one of the very best varieties of pears, said to be of French origin, and was introduced into this country by Col. Marshall P. Wilder. The tree is vigorous and hardy, the fruit large, with a short thick fleshy stem, surrounded by russet. Skin of a greenish color, sprinkled with russet, and sometimes tinted with faint crimson, and thickly dotted with brown and crimson. Flesh nearly white, deliciously vinous and juicy. Ripens in October and November.

**Duchesse d'Angouleme.**—This is a very large variety of pear, sometimes weighing a pound and a quarter. It is said to be a natural seedling, found in the forest hedge near Angers. It is very large, oblong obovate in form, with a somewhat uneven surface. Skin greenish yellow, streaked and spotted with russet. Flesh white, very rich and juicy, and of excellent flavor. Ripens in October.

Fuller, in his Pear Culturist, relates the following bit of romance in connection with the celebrated Duchesse d'Angoulême pear: A French nobleman, observing his tenant about to destroy a fine, thrifty pear tree, inquired the cause. He was told that it was a chance seedling, and had borne no fruit in twenty years. He had already cut its roots preparatory to the first stroke, but was ordered to let it remain. He did so, and in the following year it was loaded with superb fruit of an entirely unknown variety, which at once became celebrated. The root-pruning the gardener had given it worked like a charm. Not many years afterwards, when the Duchesse d'Angoulême was passing through Lyons, its inhabitants sent to her their hospitalities. Nine fair maidens presented the Duchesse with golden salvers, on which lay heaped this precious fruit, and begged her to bestow on it her name; and the pear, now recognized as the crowning glory of all fruits, was thenceforward known as the Duchesse d'Angoulême.

**Flemish Beauty.**—An old variety, said to be of Belgian origin. The tree is very hardy and productive. It should be gathered sooner than most varieties, since if left upon the tree until it parts from the branch readily, it will be of poor quality and soon decay, but when ripened off the tree, very fine flavored. Fruit, large and roundish in form, skin of a pale yellow ground, but mostly covered with patches and streaks of light russet, shading to a reddish brown when matured and exposed to the sun. Stalk short; flesh yellowish white, rather coarse grained, but exceedingly juicy, fine flavored, and rich. Ripens the last of September.

**Bloodgood.**—An early pear, of very high flavor, and is one of the best of early varieties. The fruit is of medium size, slightly obovate, thickening abruptly into the stem. Skin yellow sprinkled with russet, flesh yellowish white, fine grained, and melting with a rich, sugary, aromatic flavor. It ripens from the early part of July to the middle of August.

**Clapp's Favorite.**—This fine pear was raised from seed by Mr. Thaddeus Clapp of Dorchester, Mass. The fruit is large, obovate; surface a little uneven, skin pale yellow, faintly marked with crimson, and thickly sprinkled with russet spots, when grown in a sunny exposure. The flesh is white, fine grained, juicy, melting, sweet, vinous, and rich. Ripens the last of August and early in September.

**Louise Bonne.**—An old French winter variety, large, pyriform, skin smooth, pale green in color, flesh white, rather coarse grained, juicy, and sweet. A good winter variety, ripens in December.

**Howell.**—This valuable pear was produced by Mr. Thomas Howell of New Haven, Conn. The fruit is rather large, roundish in form, light yellow in color, with a slight blush finely shaded when exposed to the sun, thickly sprinkled with fine russet dots. Flesh somewhat white, juicy, brisk and vinous in flavor. Ripens in September and October.

**Keiffer's Hybrid.**—This variety was produced from the seed of the Chinese Sand pear, accidentally crossed with the Beurre d'Anjou or some other kind growing near it. The tree is a vigorous grower and prolific bearer. The fruit is of medium size, somewhat oval in form, narrowing at both ends. In color it is a deep yellow with a few patches and sprinklings of russet; flesh whitish, slightly coarse in texture, juicy, and sweet. The quality is very good, and resembles that of the Chinese Sand pear. It is best when gathered at mature growth to ripen in the house. It ripens in October and November. It is such a

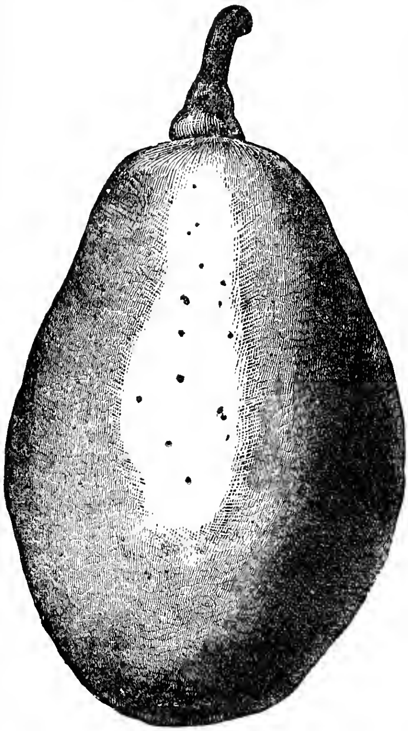
KEIFFER'S HYBRID PEAR.

prolific bearer that the fruit will be much improved by thinning after the blossoms are well set. The cut of this pear and that of the Leconte represents fruit grown by Mr. William Parry, of Cinnaminson, N. J. It is a valuable fruit, both for the table and market.

**Seckel.**—This is one of the best of American pears. It originated on the farm of a Mr. Seckel near Philadelphia, and is the richest, most exquisitely flavored, and sweetest variety known, it being unsurpassed in this respect by any other American or European

variety. The tree is very healthy, prolific, and hardy, and may be easily cultivated in any small garden. The fruit will increase in size if a top-dressing of manure is frequently given the roots. The fruit is quite small, obovate, and regular in form. Skin russet green, with a bright russet red cheek when exposed to the sun. Flesh yellowish white, buttery, very juicy, sweet, and melting, with rich spicy flavor. It ripens gradually from the first of September to the last of October, and should be gathered from the tree when fully grown, and ripened in the house.

**Louise Bonne de Jersey.**—This pear is known by various names, but more generally by the one here given. It originated in France, and is a very vigorous, productive variety. This fruit is large, oblong, a little one-sided, pale green when grown in the shade, but shaded with brownish red when exposed to the sun, and dotted with gray. Flesh greenish white, very juicy, and rich. Ripens in September and October.



LECONTE PEAR.

**Leconte.**—This is an old variety, originally from a cross between the Chinese Sand pear and one of our cultivated varieties. It was introduced about forty years ago by Major Leconte of Georgia. The original tree is reported to be still healthy and bearing abundantly. It is extensively grown in Georgia and other Southern States, where it is very highly esteemed. It is a large, yellow pear, of good quality, some of the specimens having been known to measure ten inches in circumference, and weigh twelve ounces. The *Southern Farmer's Monthly* says of it: "The parent tree is in Liberty County, Ga., sent there forty years ago by Major Leconte, and is the greatest bearing tree known, having borne thirty-nine bushels of pears at a single crop. It has no 'off years,' but continues to bear the same heavy crops every year; and has *no disease, blight, or insect* destroyer up to this date. The fruit of this pear is bell-shaped, of a rich, creamy yellow color when ripe, very smooth and fine-looking, and one of the best pears we have for shipping. It ripens in July, and sold in northern markets the past season for $4.50 per crate of one bushel each."

**Soil and Cultivation.**—Although the pear may be grown in a variety of soils and climate, it being widely cultivated in this country from Maine to Texas, as well as on the Pacific Coast, where some of the largest and most beautiful specimens are produced, yet the best results are obtained from a strong loam of moderate depth, with a dry subsoil. Pear trees should never be planted in a soil that is wet for a considerable portion of the year;

when localities having such soils are desired for planting pear trees, they should first be thoroughly underdrained. Soils that are too heavy and rich stimulate the tree to an excessively luxuriant growth, which results in the wood of the tree not becoming fully ripened, and in consequence it is liable to be winter killed by blight. On the other hand, soils that are too light require enriching by trenching or top-dressing with richer soil or suitable manure. In a cold climate pear trees should be planted on a southern slope, where they will have the benefit of the warm sunshine; but in a warm climate a cooler site should be chosen. Standard pears are generally planted about thirty feet apart, dwarfs considerably nearer according to the size they will attain when full grown. Pear trees that have arrived at a bearing age should have a top-dressing of manure applied every autumn, unless the soil is otherwise quite rich. Chip dirt of good quality, wood ashes, and iron filings are excellent for pear trees, especially the latter. It is stated by those who have tried the experiment that pear trees fertilized annually by sweepings from a smith's shop in which there are a large quantity of iron filings and small bits of iron, give a large yield of excellent fruit. Pear trees require but little pruning, in fact less than any other fruit tree.

**The Proper Time to Pick Pears, Storing, etc.**—Pears differ from all other kinds of fruit in respect to the time of gathering. While all others attain their highest degree of perfection in being allowed to remain on the tree until fully ripened, pears are best if picked when of mature growth, and permitted to ripen off the tree in a dark place. In fact, many of the choicest and most delicious varieties would be almost worthless if allowed to become mellow on the tree.

The following directions, from one of the best authorities on this subject, will be found of value to all who cultivate this fruit: "If taken off the trees too soon, the fruit withers before it ripens; while if left on too long, loss follows from evaporation and decay, the fruit being of an inferior quality. To avoid these evils, then, should be the aim of those fruit growers who are not already familiar with this part of the business—an important one for those who grow pears for profit. There is a change in color which takes place in pears that is a sure sign of ripeness to the experienced eye. This is always accompanied by unmistakable marks which, being consulted by the novice, there need be no loss from untimely picking. The seeds of pears always change from a light to a dark brown color when the fruit is matured, and will, when gathered and placed in a proper place, ripen without withering. Another and safe rule to follow in gathering pears is to watch for the swelling of the end of the stem attached to the twig, and, by raising the pear gently by hand, it separates without effort; while, with a green specimen, no such separation can take place unless force is used. Neither for home use, nor market, should pears be allowed to ripen on the tree, for the quality of such will always be inferior to those ripened in a dry, dark, and cool atmosphere. Pears intended for market should be hand-picked, sorted into two sizes at the time of gathering; and a stem upon each pear is an important appendage, making a difference in their favor of from 10s. to 20s. per barrel, which is the most convincing argument. In practice, it seldom happens that all the fruit on a tree is fit to gather at the same time. Going over the trees two or three times in a period of the same number of weeks, taking off each time the fruit far enough advanced, will be found the best practice to follow. In picking, sorting, and packing, avoid rough usage, for whenever pears are bruised, they rot before ripening, and of course such blemishes will tell against the fruit. Delicate and thin-skinned sorts are more easily injured by rough handling than varieties with tough skins, like Duchesse d'Angoulême, Beurré Bosc, and Lawrence; but, whether tough or tender, rough handling should be avoided. Pick pears only on dry days, and under no circumstances is it best to pack such fruit for market until it has cooled off, which it will in a few hours, if placed in a dry, cool atmosphere, to which darkness should be added if the fruit is kept in bulk for any length of time after picking. Where the latter is the case, it is well to turn the heap over by hand, say

once in ten days, taking out bruised or decaying specimens. No vegetables should be stored in the same room with pears, for the latter are sure to acquire the flavor of the former."

Where pears are cultivated in abundance on a farm, a fruit room devoted to the purpose of ripening the fruit will be almost a necessity, so important is the ripening of it off the trees in a dark, dry place. Such rooms require to be filled up with shelves in tiers, upon which the pears are laid; also to be kept dry and at a cool temperature. When such a room is not at command, shallow drawers may be used for storing the pears for ripening, putting in the bottom of each drawer a cloth or paper, then a layer of pears and a layer of cloth, thus keeping the pears from touching each other. Woolen cloth is the best for this purpose. Winter pears should be allowed to hang on the tree as long as possible, in order that the fruit may be perfectly mature, or until the nights become frosty. Such fruit will bear more cold than grapes or apples, but should never be exposed to a severe frost. Pears should always be gathered in dry weather. Each specimen of fruit should be wrapped in paper, be packed in kegs, barrels, or boxes, and put in a cool, dry room, but should not, however, be exposed to frost. About two weeks before the time of using, winter pears should be brought into a warmer room, as this will cause them to become mellow and juicy, and less tough than if ripened entirely in a cold room.

**Improving the Color of Pears.** — All fruit will be more highly colored when grown in a sunny exposure, and pears are no exception to this rule. The color of many varieties of pears may, however, be greatly improved by placing layers of the fruit between woolen blankets and allowing it to be packed in this manner for a few days. Fruit to be marketed will frequently bring a much higher price when of a rich color than otherwise.

**Retarding the Time of Ripening Pears.** — Many varieties of pears will command a much higher price in market if the ripening process is delayed from four to six weeks. This can be easily accomplished by placing the fruit in clean boxes, crates, or barrels, directly upon ice in an ice house, and covering the boxes or crates fully a foot deep with sawdust. The fruit should be treated in this manner when quite hard, and before it has commenced ripening. Removing to a warmer temperature would be necessary, in order to complete the ripening process. Fruit of all kinds, even when fully ripe, will keep much longer by placing whatever contains it upon ice. Pears should never be allowed to freeze, nor be placed in too warm a room.

**Yield of Pears, Marketing, etc.** — Most varieties of pears are usually good bearers; the yield will of course be according to the variety and the size of the tree, the dwarf trees yielding considerably less than the standards. Consequently the yield of a single tree may be from a bushel up to two or three bushels or more. In some orchards the fruit product will average a half barrel to a tree, in others a barrel or more. Good fruit will always command a good price, and it will pay to raise no other. Some fruit growers who supply the market state that from a number of dwarf pear orchards of choice varieties that have been planted from five to twelve years, they have known the fruit to bring some years from $500 to $1,500 per acre; and from standard trees to from $400 to $1,000 per acre, although $200 per acre is the more usual price. Pears grown on dwarf trees are frequently extra large in size, and in consequence being an extra high price in market.

In marketing pears they should always be securely packed in boxes, crates, or barrels, in order to prevent them from shaking about and becoming bruised in transportation. They are usually shipped when partially ripened, or rather green, according to the distance of transit. The finest colored specimens will bring the best prices if first wrapped when partially ripened in clean paper, and placed in small packages, such as boxes, crates, or flat market baskets.

**Diseases of the Pear.** — The principal disease of this delicious fruit, and one which is a serious drawback to its cultivation in many sections, is what is commonly termed *the pear blight.* This is supposed to be of two kinds, or rather is produced by two distinct causes, viz.: the INSECT BLIGHT, and the FROZEN SAP BLIGHT. There is also a slug worm that in many localities does great damage to pear trees from the middle of June to the middle of July. Aside from these, the other diseases incident to pear trees are mainly such as are known to the apple tree. For treatment, see DISEASES AND ENEMIES OF FRUIT.

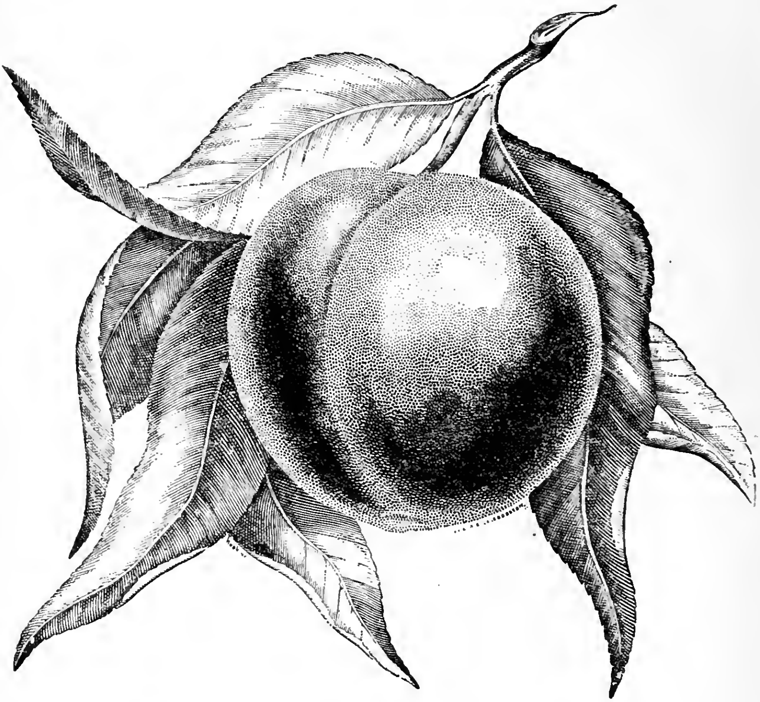
**Peaches.** — Formerly peaches were grown in nearly all parts of this country, even as far north as the State of Maine; but the removal of the forests has caused such climatic changes and increased the exposure of the trees to the cold winds and severity of winter to such an extent that now, even in central New England, it is very difficult to raise this most luscious of fruits. The peach is a native of Persia and China, and is supposed to have been brought to Italy by the Romans in the time of the Emperor Claudius. It was introduced into this country by the early settlers about the year 1680. It is easily cultivated in sections adapted to its growth, which is nearly all parts of the country, and often succeeds finely in mountainous regions, where it would seem almost impossible to produce it. In the Middle, Southern, and most of the Western States peaches are extensively cultivated, many fruit growers having orchards of from five thousand to a hundred thousand trees of different ages. The peach is short lived; consequently frequent planting of trees is a necessity.

**Varieties.** — The varieties of the peach are exceedingly numerous, new seedlings being constantly produced, to be soon succeeded by others. A few of the old standard sorts remain as good as when they were first introduced, some of which are commonly known in all sections where the peach is grown; but, as a rule, we find the varieties of the peach more transient, and also of a more local nature than almost any other kind of fruit. A few of the best varieties suited to the soil and climate are better for setting an orchard than to attempt the culture of a large number of sorts, the merits of which may not be well established. Like all other kinds of fruit, certain varieties thrive best in certain soils and sections. Among the numerous kinds in cultivation, the following may be regarded as among the best: For the Northern States — the WATERLOO, RED RARERIPE, YELLOW RARERIPE, EARLY BEATRICE, EARLY YORK, EARLY TROTH, TILLOTSON, OLD MIXON FREE, CRAWFORD'S EARLY, WILDER, PRATT'S RARERIPE, the latter a variety recently introduced by Jas. H. Dwelly, of South Hanover, Mass. The earliest varieties of peaches will generally be found most desirable for New England and the North generally, as the latest ones rarely mature well. For the Middle States — OLD MIXON FREE, OLD MIXON CLING, GEORGE THE FOURTH, RED RARERIPE, ALEXANDER, SUPERB, MORRIS WHITE, COWPER'S MONMOUTH, SUSQUEHANNA, VAN ZANT'S SUPERB, CRAWFORD'S LATE, SURPASSE, CHINESE CLING, etc., together with many of the above-mentioned hardy varieties. The kinds adapted to the South include about all those previously mentioned, and the varieties of China peaches, which meet with satisfactory results; also the LA GRANGE, GOVERNOR, THURBER, LATE RARERIPE, etc. In Florida and some other parts of the South, peaches bear well in two years from the seed, the early kinds ripening in May and June.

**Propagation.** — The peach is more easily propagated than any other fruit, arriving quickly to a bearing age. When left to itself, a peach after being planted will produce a tree that will come into bearing the third or fourth year in the cooler climate; but a stone planted in the autumn will grow during the ensuing spring and summer to the height of three or four feet, and may be budded in the following August or September. In two years from this time it will generally produce a small crop of fruit, and the following year will bear an abundant crop, unless the soil is excessively rich, producing an over luxuriant growth of branches. The following spring (in March), after budding the peach, the stock should be headed or cut back,

which will cause it to put out vigorous branches. Budding is generally practiced at the North with peach trees, but grafting is frequently resorted to at the South. Planting upon the site of an old peach orchard or tree is not to be recommended, as such soils are more or less exhausted of the elements requisite to their successful and healthy growth.

**Cultivation.**—The best soil for the peach, is a rich, deep, sandy loam, although it will thrive well on various other kinds of soils, such as the light, sandy soil of Delaware and New Jersey. The site chosen for a peach orchard will depend upon the latitude. In sections of the country where the fruit buds are liable to be cut off by the early frosts, it has been



PRATT'S RARERIPE.

found that it is better to plant peach trees on the slopes of hills with a northern and western exposure in order to avoid the early starting of the fruit buds, which endangers their being blighted by frosts. By this means the colder exposure retards the putting forth of the buds and blossoms until after all danger of frost is passed. Evergreen trees thickly planted on the north and west sides of a peach orchard will aid materially in breaking the force of the strong winds from those sources.

With respect to the culture of peach orchards, there seems to exist a difference of opinion, which is very properly based upon the nature of the soil, as will be seen by the following from the pen of Mr. Downing: "Most of the cultivators at the South say, *never plow*

or cultivate an orchard after it has borne the first crop. Plowing bruises the roots, enfeebles the trees, and lessens the crop. Enrich the ground by top-dressings, and leave it in a state of rest. The best northern growers say, always keep the ground in good condition, mellow and loose by cultivation, and crop it very frequently with the *lighter* root and field crops. Both are correct, and it is not difficult to explain the seeming difference of opinion.

The majority of the peach orchards south of Philadelphia, it will be recollected, grow upon a thin, light soil, previously rather impoverished. In such soils it is necessarily the case that the roots lie near the surface, and most of the food derived by them is from what is applied to the surface or added to the soil. Plowing, therefore, in such soils, wounds and injures the roots, and cropping the ground takes from it the scanty food annually applied or already in the soil, which is not more than sufficient for the orchard alone. In a stronger and deeper soil the roots of the peach tree penetrate farther, and are mostly out of the reach of serious injury by the plow. Instead of losing by being opened and exposed to the air, the heavier soil gains greatly in value by the very act of rendering it more friable, while at the same time it has naturally sufficient heart to bear judicious cropping with advantage rather than injury to the trees. The growth and luxuriance of an orchard in strong land, kept under tillage, is surprisingly greater than the same allowed to remain in sod. The difference in treatment, therefore, should always adapt itself to the nature of the soil. In ordinary cases, the duration of peach orchards in the light, sandy soil is rarely more than three years in a bearing state. In a stronger soil, with proper attention to the shortening system of pruning, it may be prolonged to twenty or more years."

Peaches should be planted each year, so as to have a succession of young and vigorous trees to take the place of the old ones as they die, or become unfruitful.

**Pruning the Peach.** — It has been found that peach trees thrive the best, and will produce the most satisfactory results when well pruned each year, the pruning being done very early in the season, before the buds begin to swell. The method of pruning recommended by the most successful fruit growers of the country, is to cut off half of the previous year's growth, called "*shortening in*," this to be done over the entire outside branches as well as the inner ones. By this means, the young wood, which is that which produces the fruit, is reduced one-half, and the other half left upon the tree receives all the sustenance from the sap, causing the branches to increase in size rapidly, and send out vigorous, thrifty shoots for the next year's bearing. Besides, the other advantages gained are a better-shaped, thickly-branched tree, that is more hardy and vigorous, better able to withstand the severity of the winter; hence, longer lived and more productive, while the fruit is more easily gathered, and the branches are not as liable to be broken down by the winds or the weight of the fruit. Such pruning requires considerable labor and time, where there are large orchards, but it well repays in the result; besides, this labor is not so great an objection, since it comes early in the season when other farm work is not pressing.

The editor of the *Fruit Recorder* thus gives his experience with the different methods of pruning, and the result in favor of that above advocated: "We have planted out and grown thousands of peach trees within the past twenty years, and have now growing on our grounds at Palmyra, fully five thousand trees of different ages, and from our experience, we are confident that to have long lived and productive trees, this shortening in process must be attended to timely and regularly. The fruit orchard we set first, of 1,800 trees, we trimmed up the limbs from the body and thinned out the tops, following this up from four to six years, and the result was that these trees grew up tall and spindling — the fruit and heavy winds, with snow and sleet, breaking them down and ruining the trees.

The next orchard we set, we took one-year old trees and cut them right back to within one to two feet of the roots — owing to size. These made a low, stocky head the first season, and these heads we shaped by cutting back half to two-thirds the main branches of that sea-

son's growth. The result is, we have strong stocky trees now — that do not break down with their load of fruit, while the winds do not have such disastrous effect in blowing off the fruit."

Peaches should be gathered with great care to prevent bruising, as they decay very rapidly from such causes.

**Yield, Marketing, etc.** — Peach trees produce from a half bushel to six bushels or more of fruit each, according to the size of the tree, and the care given. They are generally shipped in bushel crates, or peach baskets holding about half a bushel each, the price ranging according to the season, the supply of fruit, and the quality. Some of the finest peaches are grown on elevated land within a mile or two of large bodies of water. The sale of peaches will range according to the season, etc., from $100 to $600 per acre. When desired, they can be kept from two to four weeks longer than otherwise, by putting the crates on ice in the ice-house and covering with blankets, or other material. In packing for market, the fruit should be put in very compact, in order to prevent shaking about and bruising.

**Diseases and Enemies of the Peach.** — Great detriment to peach culture has been found in the *peach-borer* or *peach-worm*, which bores into the bark of the tree below the ground, frequently entirely girdling it; also the disease known as the *yellows* and the *curl*. In the former the principal characteristic is that of the leaves turning yellow, or being nearly destitute of color, the leaves curl and finally drop from the tree. For treatment, see Diseases and Enemies of Fruit.

**Nectarines.** — The nectarine is a species of peach, having a smooth skin. The tree resembles that of the peach in general appearance and can scarcely be distinguished from it. The fruit is considerably smaller than the peach, however, without down, and very wax-like in appearance; in flavor it somewhat resembles the peach, although not quite as juicy. Nectarines are so closely allied to the peach, that both peaches and nectarines have been known to grow upon the same branch, and nectarines when planted have been known to produce peaches, and the reverse. The variety known as the Boston Nectarine is said to have originated from a peach stone. This fruit does not seem to be quite as hardy and productive in this country as the peach, although it differs in this respect in different localities.

**Varieties.** — The principal varieties of the nectarine are the Boston, a fine seedling raised from a peach stone by Mr. T. Lewis, of Boston; the Albert, one of the finest varieties, but requiring a warm location and soil to ripen well; the Downton, a large variety of very good quality; the Early Newington, early, and one of the finest of the clingstone nectarines; Early Violet, considered by many the *best* of all varieties. It is of French origin, very hardy and productive. It is large in size, has a delicious flavor, red flesh, and dark colored stone. Skin pale, yellowish-green, and when exposed to the sun, is mottled with dark purplish dots. The Elruge, a choice English variety much resembling the Early Violet; Hardwick's Seedling, a choice variety and very hardy and productive; Hunt's Tawny, an early, prolific variety, very hardy; Pitmanston's Orange, considered one of the best of the yellow-fleshed varieties; Stanwick, a white-fleshed, later variety of fine quality; Roman, a very old kind, of excellent flavor, and the New White, a fine, light-skinned fruit of more than average quality. Among the best and hardiest nectarines for northern latitudes may be mentioned the Violet Hative or Early Violet, Elruge, Hardwick's Seedling, Hunt's Tawny, Boston, Roman, and New White.

**Cultivation, Pruning, etc.**—The cultivation, pruning, etc., of the nectarine is precisely like that of the peach. It will grow wherever the peach thrives, yet it will not produce large, fine fruit unless pruned annually according to directions given for peach culture. The *curculio* has thus far been the greatest obstacle encountered in the cultivation of nectarines in this country.

**Plums.**—The origin of most of the cultivated varieties of the plum may be traced to Southern Asia, or the southern portion of Europe, although there are three or more species of the wild plum in this country; these are, however, very rarely grown in gardens. since the cultivated varieties are so greatly superior to them in quality. Plums are delicious fruit. and if the curculio,—the enemy most destructive to this fruit,—can be kept at bay, they may be easily raised in great abundance, since the tree is naturally hardy, a vigorous grower, and very productive.

**Varieties.**—There are a large number of varieties of the plum, and additions to the list are frequently being made by seedlings raised in this country. Still we know of nothing better than one of the old and well known varieties, the GREEN GAGE, although there are others that approximate near to it in quality. Other fine varieties are the IMPERIAL GAGE, PURPLE FAVORITE, WASHINGTON, COE'S GOLDEN DROP, JEFFERSON, MADISON, LOMBARD, RICHLAND, REINE CLAUDE DE BAVAY, and SMITH'S ORLEANS. The first mentioned may be regarded as of the best quality; the Washington, Jefferson, Madison, and Imperial Gage are among the largest and most beautiful of plums, while Coe's Golden Drop, and Reine Claude de Bavay are fine late maturing varieties.

**Cultivation, etc.**—Plums are commonly propagated by sowing the seeds of almost any thrifty growing variety, and the trees budded when about two years old with a choice variety desired for propagation. Like the peach, and other similar fruit, the stones should be planted in the autumn. The soil best adapted to the plum is a heavy loam, or soils in which there is a considerable amount of clay. It will, however, grow vigorously in almost any section of the country, but fruit of the best and finest flavor is produced on soils of the above mentioned quality. Sandy soils are most liable to trouble with the curculio than others, although none are entirely exempt. Common salt has been found one of the best fertilizers for this fruit, to be applied as a top-dressing about the roots. The plum thrives best when shallow cultivation is given the soil; in fact, it cannot give the best results possible to be obtained, in turf ground. But littlep runing is required, except thinning out and taking away decayed branches. Old trees may be rejuvenated in a measure by heading them in rather closely, and applying a good top-dressing of salt, wood ashes, and other fertilizers to the roots.

**Diseases and Insects of the Plum.**—There are but two serious obstacles in the successful culture of the plum in this country, and these are the curculio or plum weevil, and the black knot. For description and treatment, see DISEASES AND ENEMIES OF FRUIT.

**Apricots.**—A native of Arabia, and the higher regions of Central Asia, the apricot requires a rather warm climate, and a rich, dry soil, to attain its highest degree of excellence. It is, however, grown quite successfully in some sections of the North, but thrives best in the Southern Middle, and Southern States. It belongs to the plum species, and is a very handsome and delicious fruit, ripening shortly after cherries, and before plums.

**Varieties.**—There are fewer varieties of the apricot than of most cultivated fruits. The BREDA is one of the hardiest trees for general culture, and the fruit, though small, is highly flavored and rich, making a fine dessert dish. The MOORPARK is one of the most popular and widely disseminated varieties in this country. The HEMSKIRKE, a large, beautiful English variety, is juicy, and of a rich, plum-like flavor; other varieties that might be numbered among the best are the LARGE EARLY, ROYAL, TURKEY, EARLY GOLDEN, and PEACH.

**Cultivation.**—The apricot requires a deep, dry soil of a rich quality. It grows very rapidly, and requires considerable pruning. When budded upon the plum the tree is more hardy and long lived than when budded upon the peach. In general management and

pruning, the same treatment should be given as to the peach, since it is only by careful, thorough pruning that it can be kept productive for a long time. The curculio or plum weevil is the most troublesome of all insects in the growing of this fruit.

**Cherries.**—The cherry is a native of Asia, and from thence was disseminated through all parts of Europe. It has been cultivated for fully two thousand years. It thrives well in all sections of the country, except the extreme North and South, and even there a few of the hardiest varieties may be grown. It furnishes an excellent shade, and is a very ornamental tree.

Mr. Loudon gives the following account of the use made of cherry trees in Germany and Switzerland. It is, indeed, a beautiful custom to be imitated by the government of any country,—that of planting fruit trees by the roadside for shade and refreshment to the traveler: "On the Continent, and more especially in Germany and Switzerland, the cherry is much used as a roadside tree; particularly in the northern parts of Germany, where the apple and pear will not thrive. In some countries the road passes for many miles together through an avenue of cherry trees. In Moravia, the road from Brunn to Olmutz passes through such an avenue, extending upwards of sixty miles in length; and in the autumn we traveled for several days through almost one continuous avenue of cherry trees, from Strasburgh by a circuitous route to Munich. These avenues, in Germany, are planted by the desire of the respective governments, not only for shading the traveler, but in order that the poor pedestrian may obtain refreshment on his journey.

All persons are allowed to partake of the cherries, on condition of not injuring the trees; but the main crop of the cherries, when ripe, is gathered by the respective proprietors of the land on which it grows; and when these are anxious to preserve the fruit of any particular tree, it is, as it were, tabooed; that is, a wisp of straw is tied in a conspicuous part to one of the branches. When the grapes are ripe in France, vines by the roadsides are protected by sprinkling a plant here and there with a mixture of lime and water, which marks the leaves with conspicuous white blotches. Every one who has traveled on the Continent in the fruit season, must have observed the respect that is paid to these appropriating marks; and there is something highly gratifying in this, and in the humane feeling displayed by the princes of the countries in causing the trees to be planted. It would indeed be lamentable if kind treatment did not produce a corresponding return."

**Varieties.**—The cherry embraces a large number of varieties, while new ones are being frequently introduced. Among the best ones for general culture are the Belle d'Orleans, Belle de Choisy, Black Tartarean, English Morello, Early Purple Guigne, Coe's Transparent, Governor Wood, May Duke, Black Earle, Early Richmond, Napoleon Bigareau, and Yellow Spanish. Varieties bearing heart-shaped fruit are the best for shade, and generally the most prolific. The Duke and Morello are the most hardy for very cold climates.

**Cultivation, etc.**—The cherry requires a dry soil, and will not thrive well in one that is saturated with moisture. It succeeds best in a good sandy or gravelly loam, although it is a hardy tree, and will do well in a great variety of soils. It is propagated similar to the plum, apricot, and peach and requires but little cultivation, and no pruning, except when it is desired to remove a dead branch, or to prevent the branches from crowding. Pruning is apt to cause the gum to exude, and this produces decay of the wood, hence pruning should be avoided except when necessary. With young trees, pinching in of the branches in summer for a few years is practiced by many fruit growers. The cherry is not generally a very long lived tree, but in a favorable soil and climate it frequently lives from thirty to forty years. Mulching for the first season after planting is to be highly recommended, while root pruning in mature or old trees will frequently induce fruitfulness. Old trees may also be kept fruitful and vigorous by a top-dressing of manure.

**Diseases.**—The cherry tree is not troubled to any serious extent with insects, and has but few diseases. On soils where the bark of the trees split open, it is better to have the lowest branches low on the trunk, or within three or four feet of the ground.

**To Prevent Birds from Robbing Cherry Trees.**—The best method of preventing birds from helping themselves too liberally to cherries is to encourage the king-bird to build her nest near the trees. It has been found that if tempted by scraps of cotton, strings, or small shreds of other loose material for building a nest,—these to be left in the vicinity in which it is desired to have the nest located,—the king-bird will soon accustom itself to building in and about the orchards, gardens, and even buildings of the farm.

Professor W. A. Stearns of Amherst, Mass., gives his experience in this connection as follows: "It is well known that the king bird, the most fearless fighter of the feathered tribe, attacking with violence crows, hawks, and, in fact, any bird that interferes or intrudes in the domestic arrangements of its helpmate, is particularly active in preservation of self and family during the season of nidification and incubation. Several years ago I found that one of these birds built its nest and raised its family in the corner of an eave-spout at the front end of our house. Not five rods from this place stood a cherry tree, of the variety called the ox-heart. Here for years we had struggled to see who would get a taste of this most delicious fruit. For an equal amount of time it had been 'nip and tuck,' so to speak, between the birds and ourselves. We had tried red flags in the tree, and the birds minded them not a straw; we had put scarecrows and old hats in among the branches, and the birds lighted upon them, and mocked at our efforts; we had tried shooting, and though a few birds were killed, ten came to the funeral of each, and many of the fine limbs of the tree were so riddled with shot that they died during the following autumn and spring. What to do we did not know.

In our dilemma we suddenly, one season, found the tree clear of robbers, and in surprise and delighted wonderment we feasted off the delicious fruit the whole of that season. The next season was the same. No apparent cause could be ascertained for this reign of quiet for a considerable while. It was at last discovered that while our friend the king-bird continued its nest in the eave-spout, no other bird was allowed nearer than a radius of some twenty or more rods of the tree. This took in another similar tree upon the opposite side of the walk. Thus had been raised to us a natural protector of our fruit. We cultivated the acquaintance of our favorite, threw cotton and pieces of string where he would find them, and were delighted to find that he took kindly to our suggestions and appeared to become domesticated. Finally, one year, lately, he disappeared, whether killed or not by some mischievous boy or unscientific sportsman, I do not know. To our disappointment the birds returned, and our cherries were eaten up."

Old seines or fish nets spread over the tree will prove a good protection; also small pieces of bright tin, or looking glass tied to a string two or three feet long, and fastened to the end of a pole, which is securely placed so as to sway in the wind above the branches and reflect the sunlight, will frequently frighten the birds away. Fine thread wound around the tree so as to be distinctly seen will also answer the same purpose at times, but the means that prove successful during one season will not always the next, and for this reason the king-bird, as previously stated, is the most sure prevention that can be recommended.

**Quinces.**—The cultivation of the quince is more limited in the United States than it ought to be, for it is a very valuable fruit, easily reared, and commands a high price in the market. The fruit resembles the orange in external appearance more than any other, while the tree grows more like a stout shrub than a tree. Its large blossoms of white and delicate pink are quite ornamental during the blossoming season, and its golden fruit is no less so when fully ripe. Its principal use is for preserving, it being one of the most delicious fruits

for this purpose, while its piquant flavor is readily communicated to other fruits, such as apples, when cooked with it. It is also excellent for household purposes when dried. With proper care and suitable soil, the quince may be easily cultivated in all parts of the country, and there is no fruit that can be more profitably grown in sections to which it is adapted.

**Varieties.**—The Orange is the most popular variety of quince, and may be called the very best of all, the fruit being large, round, fine-grained, excellent flavored, and—when cooked—very tender. The Angers is a hardy, productive variety, of good quality. The Champion is a recent variety, now quite popular. It was found growing in a garden in Danbury, Conn., and has since been widely disseminated. It is much larger than the Orange, quite hardy and productive, but the fruit is coarse-grained and less delicate in flavor than the latter. Rea's Mammoth is also a large new variety of promise. When we consider the value of the quince, whether for home use or market, it is surprising that so little has been done during the last half century to improve it.

**Collecting, Gathering, etc.**—The quince may be propagated from layers, cuttings, grafting, budding, and the seed, but more commonly from layers or cuttings, since when produced from seed it is more liable to vary in form and quality. The following directions from a successful grower of this fruit in Northern Connecticut will furnish excellent suggestions relative to its culture: " It is true quinces have not of late years been cultivated as much as formerly, or as much as would have proved profitable to the cultivators. Many of those who have attempted quince culture have failed to bestow the necessary care, and in fact have planted the bushes in out-of-the-way and unfavorable places. Above all others we should recommend the Orange variety. If set from eight to ten feet apart, quince bushes will soon cover the ground so as to keep down the weeds and render the labor of cultivation light.

Until they do cover the ground, they should be well taken care of, and this the borers will compel if one expects to obtain fruit. These insect pests should be hunted out and destroyed the same as they are from apple trees. It is a very good plan to apply a bushel or two of coal ashes in the fall to form a mound around the trunk, and then spread the ashes out late in the spring. Quinces are easily propagated by cuttings which are usually taken off in spring early, from wood of last year's growth, and about one-fourth in length. The buds should all be cut out except the two upper ones, and the cuttings set erect about ten inches deep in rich, moist, sandy soil. If the ground is available where moisture can be assured in summer without a surplus of water in winter, or which can be disposed of by draining, it is the most desirable location for quinces. The month of September is the best time for making and putting in the cuttings. Small beds may be made well shaded from noonday sun, and watered during the summer season.

Quinces can also be propagated by layers, which are made in the spring by bending down and pegging. They usually form roots the first season, and will answer the following spring to be cut from the parent plant and transplanted into nursery rows. If raised from the seed quinces can be budded or grafted the same as the apple or the pear. The soil for successful growth should be rich and not less than two feet deep, and kept free from grass and weeds. Barnyard manure well rotted and spaded in, will not only improve the quantity, but also the quality of quinces. New plantations, if to be made in old, worn-out soils, should first have a liberal dressing of virgin earth composted with leaf mold from the woods. A free use of liquid manures, applied during winter and spring, has a decidedly beneficial effect upon the quantity and character of the fruit. Peat muck is often applied with good effect, composted with wood ashes.

A shaded situation, so often advised, should be avoided, since the quince requires as much sunshine as any other fruit. Fall is the best time for transplanting the quince, though

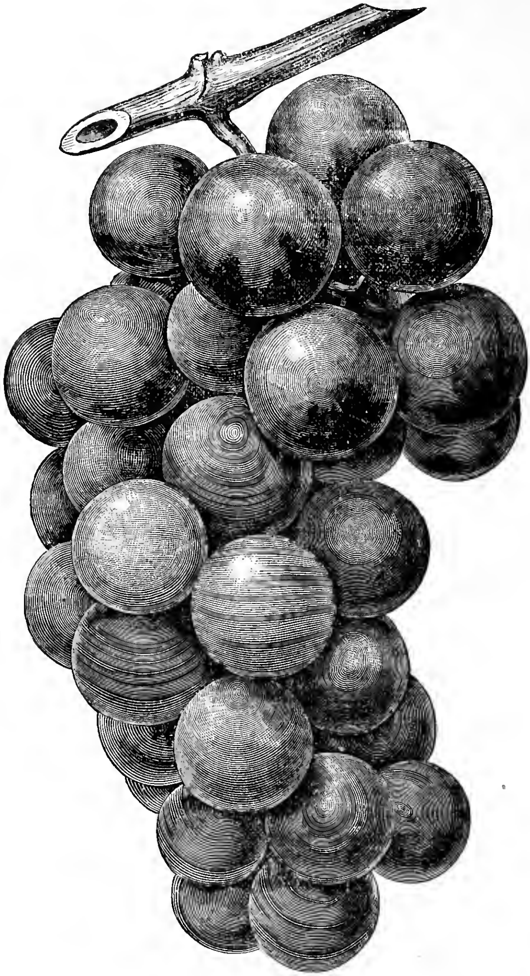
this can be successfully performed in the spring, and sometimes when well advanced, as it is a hardy plant and its roots strike very readily. It is always best to head back freely when transplanting. No fruit is more easily injured in its appearance by careless harvesting than the quince. Every bruise on its skin is followed by discoloration and decay, and consequently such specimens have poor sale in the market. Pick by hand, lay gently in the basket, and remove as carefully into barrels, treating the quince the same as the apple in handling and transporting."

Some plant the quince cuttings from five to six feet apart. Salt is an excellent fertilizer for quince trees, and if applied broadcast annually at the rate of five bushels per acre on poor soils, or ten bushels on rich soils, it will greatly promote their fruitfulness. This amount of salt would injure many fruit trees or plants, but will prove beneficial to quinces. Mr. P. M. Augur, pomologist, says: "Fertilizers suited to the pear will answer for the quince. For the last four or five years I have applied my refuse brine to my quince bushes, resulting in vigorous growth and abundant fruitfulness. I pour it in early spring, as soon as the frost is out of the ground, a few feet from the bushes, about six quarts to each plant."

**Diseases.**—The borer frequently attacks the quince, the same as the apple, but this fruit is subject to but few diseases, or other insect enemies. A peculiar disease similar to the smut in grain has recently made its appearance on the quince in some sections, and is supposed by many to be propagated by spores in the same manner, although not well understood. Apply salt and wood ashes for a top dressing about the roots in the spring, and whenever the disease makes its appearance, cut off all the young fruit or small branches affected as soon as possible and burn them.

**Grapes.**—Grape culture was practiced in the earliest period of the world's history, and may be said to be coeval with the history of man. It grows in Syria and Persia in the highest perfection, and was carried from thence to Egypt, and from there to Greece and Sicily, making its way gradually to Italy, Spain, France, and Great Britain, it being carried by the Romans to the latter country about two hundred years after Christ. The seeds of the European varieties were brought to this country by the early settlers. There are several species of the wild grape in this country which are distinct from the wine grape of Europe, and from which many of our present valuable varieties have been produced. These wild grapes are generally stronger in their growth, with larger and more entire foliage than the European varieties, and in their native state have a peculiar sharp flavor with more or less hardness of pulp. Grape culture has developed wonderfully in the United States during the last quarter of a century, and is still rapidly increasing, the grape being one of our most valuable and delicious fruits. In fact it is hardly surpassed in aroma, flavor, and beauty, by any other fruit. It is also very nutritious and healthful. Mr. Wilder says with reference to grapes:

"No other fruit, unless it be the strawberry, now attracting so much attention, and perhaps no other, if we except the apple, is of more importance as a source of revenue, or an article of luxury for our tables than the grape. No other country possesses such a vast extent of territory, or possibilities for its successful culture, and in no other section of the globe is there, at the present time, such encouragement thereto. In fact, it seems as though Providence had designed many parts of our continent especially for its cultivation. The Scandinavians—as the Sagas have it—eight hundred years ago, here found the vine growing so abundantly that they gave to our coast the name of Vineland. Champlain, in his voyages on our coast about five hundred years afterwards, saw vines in abundance. The pilgrim fathers, at Plymouth, found grapes, "white and red, and very strong," and should the phylloxera continue its devastation in the vineyards of the old world, our country may become the most favored vineland of the world.



MOORE'S EARLY.

In the whole circle of our pomological progress there is no fruit which excites so much enterprise and interest, so rapidly being extended, or which gives greater promise of success than the culture of the grape, and should this same enterprise continue for fifty years to come, we can hardly estimate its value as a revenue in our country. All localities are not equally suited to its growth, but where our wild species are found, other new and improved sorts, produced by hybridization, will be found equally well adapted. With every succeeding year new and valuable varieties are coming to notice, either adapted to special locations or purposes, or for general cultivation. Nor is it too much to hope that ere the close of this century, with our present zeal and skill, we shall produce varieties that will rival the choicest kinds of the most favored climes. Even now we have those which compare favorably with our foreign varieties, and we believe the time is not distant when the aroma of our native sorts, now so much despised by some, will become, when chastened down as it has been in the Brighton, Duchess, Rochester, and Monroe, one of the excellent characteristics of our American grapes.

How potent the influences of this art! Little did Mr. Bull think what a blessing he was conferring on the world when he sowed the seed which produced the Concord grape,—the mother of so many improved varieties. See the number of white varieties (not to speak of others) which have been produced mostly from this: the Martha, Lady Pocklington, Lady Washington, Hayes, Ann Arbor, Prentiss, Duchess, and others soon to be within our reach.

The illustrations of this improvement are manifested in the numerous seedlings obtained by crosses on the Concord, some of which are of a very remarkable character, possessing great size and beauty, and whose vigor and productiveness are declared to be even greater than that of their mother. We see this improvement also in the crosses of a wild grape with the foreign species by Rogers, as shown by the amelioration of the native aroma in the Barry, Wilder, and Lindley, the last named, like the Jefferson of Ricketts, possessing a peculiar rich flavor which might, with propriety, be denominated and may yet be distinguished as the Muscat of America.

Nor do I doubt that we shall in time produce varieties which will compare favorably with, and perhaps be equal in size, beauty, and excellence to the Cannon Hall, or other Muscat, now so highly praised for their peculiar aroma. The Pocklington, in size and beauty, is an approach to this. Nor is it unreasonable to suppose that we may have a grape, if we have it not now in the Duchess, that is as well adapted to exportation as the White Malaga, and of much better quality. What has been done can be done again. Nature has in her laboratory infinite stores of the same elements which have produced our finest fruits, and we have only to knock at her portals, and pronounce the sesame, when she will open to us the secrets of her wonder-working power."

**Varieties.**—Among the many varieties of grapes cultivated, there are some which will thrive best in the Northern section of the country, others that seem better adapted to the Middle portion, others still that attain their most perfect development at the South, while there are a few varieties that can be relied upon for good results in almost any portion. Like most other fruits, the grape varies more or less in quality, according to the section in which it is grown.

**Concord.**—This is one of the best of the older varieties of grapes, and is probably raised more extensively in this country at the present time than any other. It succeeds well in about all parts of the country, but probably better at the West and South than in New England, although growing in the latter section more commonly than any other variety. It thrives finely as far south as Florida. It was raised from seed by Mr. E. W. Bull, of Concord, Mass. The vine is very hardy, vigorous, and productive. The berries are large, globular, nearly black, and thickly covered with bloom; flesh sweet and juicy; bunches large and compact. Ripens early.

**Catawba.**—An excellent variety of native grape that originated in the State of Maryland. It does not ripen sufficiently early for cultivation in the Northern States, but is one of the best kinds in sections adapted to its growth, and is a very popular and profitable market variety. It seems to be most rich when grown in clay shale soils, but does well in those that are gravelly or sandy. The bunches are of medium size, somewhat loose; berries rather large, pale red in color, covered with a lilac bloom; very juicy and sweet, with a musky flavor, and highly aromatic. The fruit may be kept fresh till late in winter, with proper care. The vine is very hardy and productive, but uncertain, except in favorable locations.

**Brighton.**—This beautiful and excellent grape originated at Brighton, N. Y., being a cross between the Concord and Diana Hamburg. The vine is quite hardy, very productive, and a rapid grower. The bunches are of medium size, moderately compact; berries medium

BRIGHTON GRAPE VINE.

(From a photograph showing three feet section of the original vine.)

size, round, light bright red at first, changing to a dark crimson or maroon when fully mature, sometimes almost black, and covered with a thick lilac bloom; skin thin; flesh sweet, juicy, and slightly aromatic. It has its best flavor when first ripened. An early ripening variety of good quality.

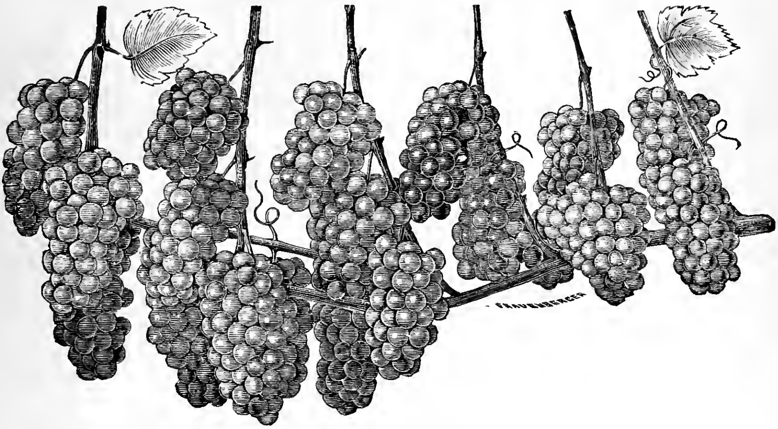
**Hartford Prolific.**—A fine, early grape raised by Mr. Steel, of Hartford, Conn. It thrives well at the North, and is hardy and productive. The bunches are rather large and compact; berry large, globular, sweet, and aromatic; skin thick, black, and covered with bloom. It is one of the earliest ripening grapes, but is liable to drop its fruit from the bunch as soon as ripe.

**Moore's Early.**—This is a fine, early grape raised from seed by Mr. J. B. Moore, Concord, Mass., and was selected from 2,500 seedlings. It is one of the earliest varieties,

ripening before either the Concord or Hartford Prolific. It resembles the Concord in general appearance and flavor, although thought by many to be superior to the latter in quality, and is very hardy and prolific.

**Pocklington.** — A large showy grape raised by Mr. J. Pocklington, Sandy Hill, N. Y., from a seed of the Concord. The vine is hardy, vigorous, and prolific, with short-jointed shoots, and large, downy leaves. The fruit grows in large, compact bunches, the berry round and large, pale yellow or whitish yellow in color when fully matured, covered with a light bloom. When fully ripe the flesh is juicy and sweet; ripens about the same time as the Concord. The cut of this variety on a previous page was made from a photograph of fruit grown by Mr. Geo. A. Stone, of Rochester, N. Y.

**Clinton.** — A vigorous, hardy variety, very prolific, and grows well at the North, and succeeds best on a moderately light soil. Bunches very compact, rather small, long, and narrow; berries round, rather small, black, covered with a thick bloom, juicy, somewhat

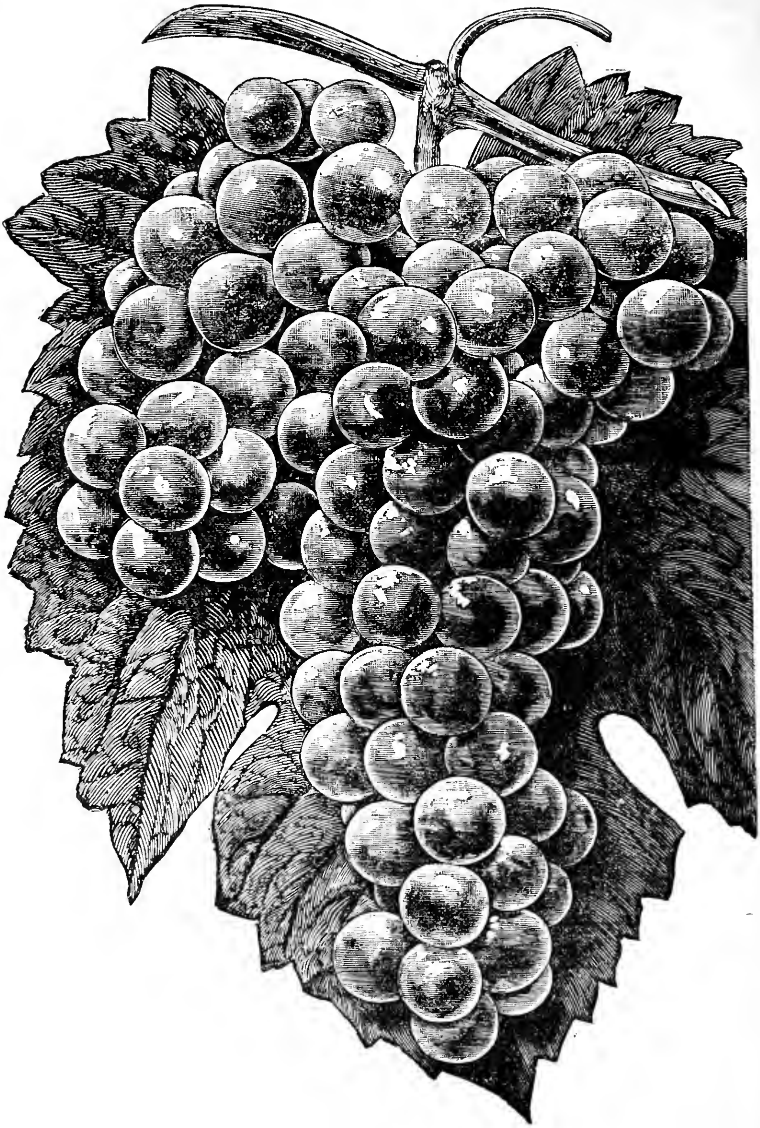


THE PRENTISS.

acid, with a brisk, vinous flavor, and possesses good keeping qualities. With proper care, the fruit can be kept nearly all winter. Ripens quite late, or after frost.

**Delaware.** — The origin of this grape is not known. It is an old variety, and was found many years ago growing in the garden of a gentleman in Hunterdon County, N. J. The vine is rather slow in growth, with short-jointed wood. It is quite hardy in sections suited to its growth, and requires a rich soil, well drained, to produce the finest fruit. It is one of the most valuable kinds for general cultivation, and is very productive. The bunches are quite small, and very compact; berries small, round, light red in color, with thin, transparent skin. It is exceedingly sweet, rich, sprightly, vinous, and aromatic. It does not prove hardy at the North.

**Prentiss.** — A seedling of the Isabella, raised by Mr. J. W. Prentiss, Pultney, N. Y. It is very hardy and prolific. Bunches of medium size, and compact; berry medium, round, inclining to oval; skin thick, greenish white, pale yellow with a thin whitish bloom; sweet, juicy, and pleasant flavored. The above illustration was drawn from a branch of this fruit twenty inches in length, grown by Mr. T. S. Hubbard, of Fredonia, N. Y.



THE DUCHESS.

**Duchess.** — This fine grape was produced by crossing a White Concord seedling with the Delaware or Walter, the pollen of both being applied at the same time. Bunches rather large, compact; berries slightly oval; color pale greenish yellow when fully ripe; flesh juicy, spicy, sweet, rich, and of excellent quality. It ripens a little after the Concord. The cut of this grape, which we insert, was drawn from fruit grown by Mr. R. H. Haines, Moorestown, N. J., and is a good illustration of the variety.

**Niagara.**—A recent variety originating at Lockport, N. Y., by a cross between the Concord and Cassady. The vine is vigorous and healthy, and is a rapid grower; bunches medium in size, or rather large; berry large, slightly inclining to oval, pale yellow, with a thin, whitish bloom when fully mature; flesh tender, sweet, and juicy, resembling in flavor that of the Concord. It ripens about the same time as the latter.

**Jefferson.** — This was produced by a cross between the Concord and Iona, at Newburgh, N. Y., and is a comparatively new variety. The bunches are large, sometimes double-shouldered, compact, with a slightly oval berry; skin light red, with a lilac bloom; flesh juicy, sweet, rich, slightly vinous, and aromatic. The fruit has excellent keeping qualities, and will remain fresh, with proper care, for a long time after gathering. It ripens about the same time as the Concord, or a little later.

**Vergennes.** — This variety originated with Mr. Wm. Greene, Vergennes, Vt., who gives its history as follows: "The Vergennes grape is a chance seedling found growing in my garden, where there are more than twenty varieties in bearing. Its vigorous growth and healthy appearance induced me to let it remain until it fruited. It has now been in bearing five years, and has proved extremely productive. Clusters and berries large, holding firmly to the stem; color light amber, flavor rich, and ripening in this locality fully as early as the Hartford Prolific, and its keeping qualities are superior to any variety that I know of. I had the fruit the middle of March almost as fresh as when picked." The vine is said to be a very vigorous, rapid grower, and does not winter-kill easily. The cut of this variety which we insert was drawn from a photograph of fruit raised by Mr. T. L. Perry, Canandaigua, N. Y.

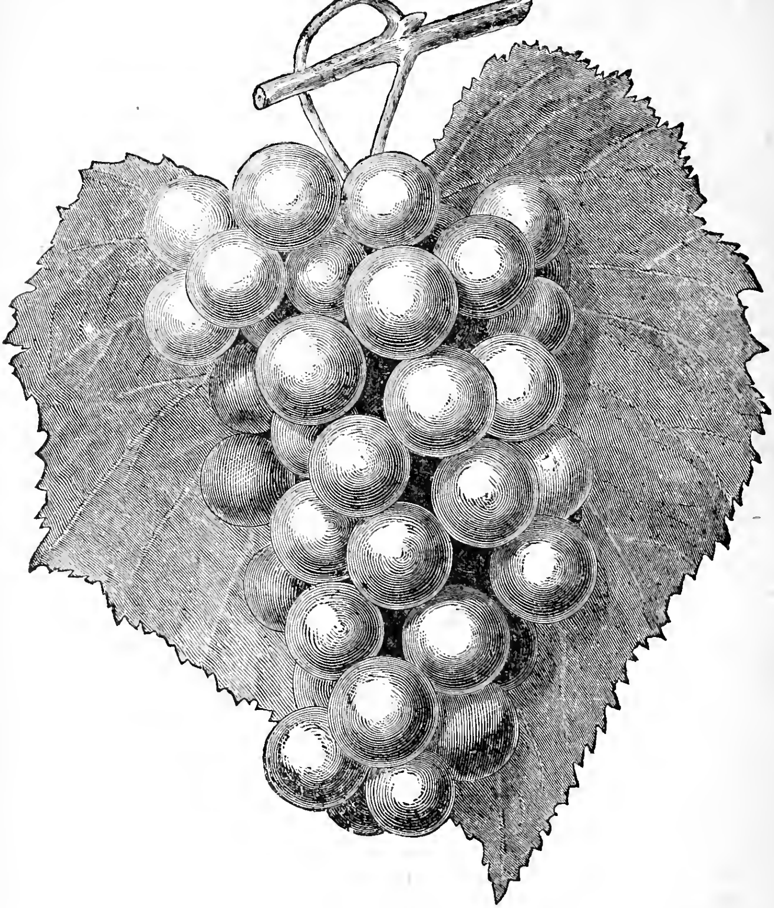
**Wilder (Rogers No. 4).** — This is a fine variety that ripens about the same time as the Concord. The vine is hardy and vigorous, the bunch large and compact, berry large, round, black with slight bloom, flesh sweet, juicy, rich, and aromatic. The fruit adheres well to the stem, and keeps well after it is gathered.

**Worden.** — This is a new variety, a seedling of the Concord, that is succeeding finely in all localities where it has been introduced. The vine is very thrifty and vigorous, healthy, and a good bearer. The bunches are large and handsome, double-shouldered; berries sweet, lively, with a slightly foxy or native flavor. Being slightly earlier than the Concord, it ripens well in cold localities.

**Scuppernong.** — Mr. Downing gives the following concerning this variety: "The Scuppernong grape is a very distinct Southern species, found growing wild, from Virginia to Florida, and climbing the tops of the tallest trees. It is easily known from every other grape by the small size of its leaves, which are seldom over two or three inches in diameter, and by their being glossy and smooth on both the under and upper surfaces. These leaves are roundish and closely serrated, and the young shoots are slender; the old wood is smooth, and not shaggy, like that of most vines.

We have made several trials with the Scuppernong grape, but find it quite too tender for a Northern climate, being killed to the ground by our winters. At the South it is very hardy, productive, and an excellent wine grape. The White and Black Scuppernong scarcely differ, except in the color of the fruit. The *tendrils* of each correspond with the color of the fruit. Bunches small, loose, seldom composed of more than six berries. Berries round, large. Skin

thick, light green in the white, dark red in the black variety. Flesh quite pulpy, except when very thoroughly ripe, juicy and sweet, but with a strong musky scent and flavor. It attains its highest perfection in Georgia, but succeeds well throughout the Southern section."



LADY GRAPE.

**Lady.** — A fine, early grape, quite hardy, and is considered by many as one of the best of the white varieties. In color it is very attractive, being a greenish-yellow covered with a white bloom; seeds few and small, skin thin, pulp tender and sweet. The berry hangs firmly to the bunch, which is of medium size. The above cut was drawn from fruit raised by Mr. William Parry, Cinnaminson, New Jersey. The vine is sufficiently hardy to succeed well in all grape-growing localities, and is generally reliable.

**Other fine Varieties** are the Diana, a grape of good keeping qualities, but of peculiar flavor; vines rather tender for cold localities; the Martha, a white variety, quite hardy, flesh sweet, slightly foxy, and ripens about the same time as the Concord. Iona, a fine variety with good keeping qualities, hardy, productive, and is considered by many superior to the Delaware. Wyoming Red, a fine, new variety resembling the Delaware, but of double the size; ripens early. Lady Washington, a seedling of the Concord crossed with Allen's Hybrid. Bunches large, compact, shouldered, sometimes double-shouldered; berry medium size; skin pale yellow, with a slight tinge of pink when exposed to the sun; flesh juicy, sweet, slightly vinous. The fruit keeps well, and ripens about the same time as the Concord. The Creveling, Isabella, Lindley (Rogers No. 9), Massasoit (Rogers No. 3), Barry (Rogers No. 43), are also all good varieties.

**Soil, Choice of Vines, etc.** — Grapes will grow in almost any soil that is suitable, if not too wet; warm, deep soils being preferred. Strong, loamy soils are excellent, limestone and clay shale being generally considered the best, while it is absolutely necessary that the soil be warm, open, and with a sunny exposure. In order to secure a sunny exposure, the land should slope to the south, but if it slope too much the land will wash badly.

Dr. Jabez Fisher, of Fitchburg, Mass., one of the best authorities on grape culture in the United States, says with reference to this subject: "We want as much of a southern slope as we can get without sacrificing too much. In that way we get south fifty or a hundred miles. That is one way to overcome the difficulty of being too far north. Then again, the particular lay of the land has considerable to do with the ripening of the grape. If we locate our vineyard in the bottom of a valley, where it is very hot in the day time, where, perhaps, the thermometer would show the highest average range of temperature during the season, we are liable to have severe frosts early in the autumn, which, although they will not spoil the grape, will injure the foliage, and very much retard the ripening. That is to be avoided. The tops of hills are also to be avoided; because they are of lower temperature, — they are further north. The very best place is on a southern slope, about two-thirds of the way up, situated on some high ground, but still sheltered by the tops of the hills. That seems to me to be the most favorable location we can get. The grape is a plant that likes heat above all things. It does not care for much moisture, but it wants plenty of heat and sunlight.

Then, in the choice of soil, the same thing is to be considered. We at the North want to get as far South as we can in that respect. Hence, we do not want a strong, clayey, deep loam; we want something that is a little lighter, and that is warm. We want a soil that will take and retain the rays of the sun as much and as long as possible. We want to raise the temperature of our climate as much as we can. Hence we would choose a piece of light soil. But there comes in the objection: a very light soil will not produce the finest grapes for market, although it may ripen them earlier than stronger soil. We are aiming at the very finest results. What I mean by success is, that we shall get a first-class product, that shall bring the highest price, or give the most satisfaction if we eat it ourselves. If we go further north, then we must choose a lighter soil and thus give increased heat and shorten the time of ripening. If we go further south, we may choose a stronger soil, as the season is longer. The further north we get, the lighter the soil must be on account entirely of this matter of heat. But right here I should choose neither the strongest nor the lightest soil. I should prefer a moderately strong, friable loam, if I could get it, on gravelly bottom; but such lands are very uncommon. We want land that is naturally drained, because a piece of land naturally drained is drier and better than a piece of land that has to be artificially drained, the soil being of the same quality. If it is not of the requisite character, so far as drainage is concerned, it must be artificially drained.

Having selected our location and our soil, we are next to consider what is to be done towards preparing the land and setting out the vines. In preparing the land, but very little

of that kind of labor is required that used to be talked about a great deal in the books some years ago. We used to be told that we must trench our soil two or three feet deep, if we would grow grapes successfully. I think that idea has been exploded, as far as we are concerned. If you go south five hundred or a thousand miles, there it is necessary to trench; there you want to get a more permanent moisture. It is a different kind of business there from what it is north. Here we want to get all the effect of the sunshine that we can; we want to get all the heat and retain it all. Hence, the original preparation should be very shallow, and the after-cultivation should be of the same character. We want to encourage the formation of roots near the surface all the time, and never to induce them to go deeply, out of the influence of the sunshine.

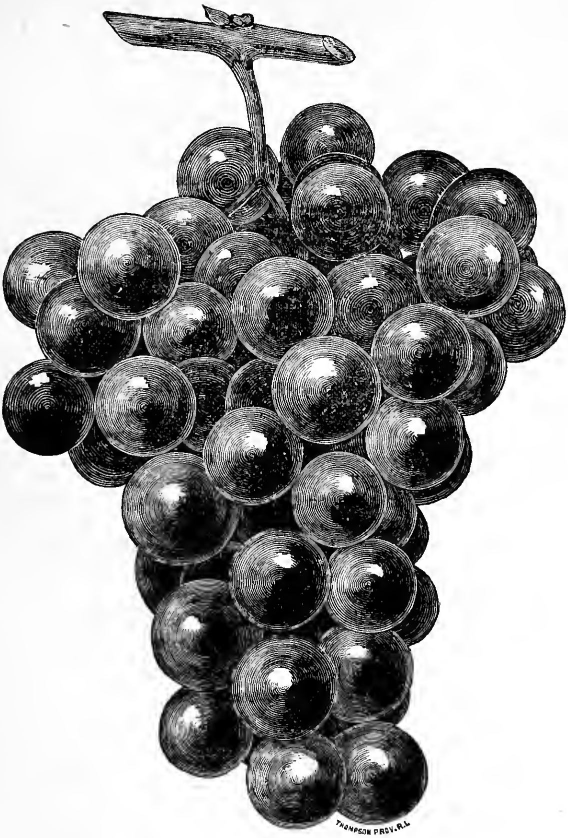
The preparation, therefore, should be simply shallow plowing. Perhaps 'shallow' is not sufficiently definite. Some people call three inches 'shallow,' and others call seven inches 'shallow.' I would not plow the ground for grapes more than seven or eight inches; that I call shallow plowing. I think there is another advantage in not going below that. My investigations into the character of the grape have satisfied me that the roots are not, generally, more than five or six inches deep. They are spread out in the ground, a perfect network, at about that depth, with only an occasional straggling root growing down deeper. The grape, as I have said, is a plant which loves heat, and it very naturally keeps its roots near the surface, where they get the heat.

It makes very little difference in what condition the ground is before you begin. There is no coating of manure that can be put upon the soil that equals the sward; I do not know of anything that compares with it. It is not very comfortable to work upon the first year, or until it has rotted, but I would never rot it by raising a crop; that uses up half of it. I would rather the nutriment contained in the sod would go to my grapes that I am planting than to something else beforehand.

We do not want to feed grape vines largely with ammoniacal manures. They cause an exuberant growth of foliage and wood; they do not bring us fruit. We want another class of fertilizers. Hence barn-yard manures are not the things to apply to grapes, and we do not want land that is full of anything of the kind. Whatever there is in the land should be rotted, unless it is sward, which does not have the influence that barn-yard manures do in their green state.

Having prepared the ground by simply mellowing the surface in any way, whether it has been under cultivation or whether it was in sward, we are prepared to grow and plant the vineyard. The first thing is, to select our vines. The best way is to go to a man who knows how to grow vines, and buy them from him. I believe in specialties in almost everything. The man who grows grape vines as his business will grow better vines than a man who does not make that his business, but who grows only a few. It is a very easy matter to grow grape vines; anybody can do it. But the trouble is this: if an amateur plants a lot of cuttings and gets a thousand vines, that he wants to set for fruiting, he will be sure to use a good many that are worthless, and should be thrown away. If he buys them and pays his money for them, he will buy the best, or should buy the best. Therefore, I would recommend farmers to purchase the vines of some experienced grape-grower, rather than to undertake to grow them themselves. Besides that, one year's growth is gained, which is virtually one year's crop of fruit.

There is some difference in the quality of vines. If I were to buy vines, I would take the very cream of those one-year-old, and pay the price; the two-year-old vines I would not buy if one-year-old ones were to be had, and the three-year-old vines I would not buy at all. My experience in setting out vines and trees has been, that the young trees and young vines always succeed best in the end. If we buy yearlings, we are very sure to get the whole system of roots; if we buy two-year-old vines, we do not get the whole system of roots,




VERGENNES GRAPE.

unless they have been transplanted. If a little pains is taken in removing a vine when it is a year old, the whole system of roots cut off the length of two or three inches and re-set, then we get a new system of roots from the whole center, and they do not grow so far; then we are more likely to get a strong vine; hence, if a vine has been grown two years, it is not so objectionable, although it is not, in my view, quite so good as a first-class one-year-old vine. I buy young vines, because I can get the whole system of roots. I care nothing for the top of a tree or vine; we can make the top if we have the roots; but we cannot make roots in open air culture, having nothing but the top to aid in producing them."

**Transplanting.**—Grape vines may be transplanted either in the spring or fall, but when done in the latter season, it should be sufficiently early to have them become well established in the soil before it freezes, otherwise they will be liable to be winter killed in the cold latitudes. The soil should always be in proper condition, mellow, and not too wet, whether the transplanting be in the fall or spring; it should also be done as early in the season as possible, so that the vines may have the advantage of the roots obtaining a good vigorous start. If set in the spring, the risk of loss during the winter, if it should be unfavorable, will be avoided. The soil should be in good condition, made mellow by the plow or spade. Never permit strong manures to come in contact with the roots. Bones are excellent fertilizers for grapes. In setting out grapes in gardens, it is a good plan to plant underneath the roots, and cover with soil, a quantity of old bones as food stored up for the roots of the growing vine, upon which they may feed as the bones gradually become decomposed. The vines for vineyard culture are planted in rows at distances varying according to the vigor of the growth of the vine; long jointed, vigorous growers for instance requiring more room than short jointed, moderately growing vines; the Concords for instance, which are vigorous growers, are frequently planted eight by eight feet, or eight by ten feet apart, while the short jointed, less vigorous growers like the Delaware, may be planted four by six feet, and varieties intermediate between these six by eight feet, and the rows eight feet apart, which will give about nine hundred vines to the acre. Crowding should be carefully avoided. The rows should run north and south in order to get the largest amount of sunlight possible, each plant getting the morning's sun on the east side, thus every branch and leaf is exposed to the sunlight during the day. Besides this, a greater advantage is gained at the time of the ripening of the fruit, since the sun shines directly upon the ground for three or four hours during the middle of the day, warming the soil, which retains the heat during the night and radiates it, consequently the temperature of a vineyard thus planted will be several degrees warmer than it would be otherwise, and the fruit ripens more rapidly and perfectly.

**Stakes and Trellises.**—The vines are generally trained on stakes or trellises, the latter being generally considered the most economical.

Dr. Fisher, the authority previously quoted, gives his method of arranging a trellis as follows: "The posts are made of two-inch square chestnut. It is, perhaps, not quite as cheap as unsawn timber, but it is very much handsomer, and if your vineyard is in sight, it will look very much better. These posts are set six feet apart through the whole vineyard, one post for one vine; they are set two feet and a half in the earth and five feet and a half out, being eight feet long. My custom is, to set the *end* post right by the side of the first vine. which makes it nine feet from the next one. The others are six feet apart. I put a brace in at the end, bracing the outside post to the foot of the next one, which brace is set into a little shoulder just sufficient to hold it. Then, upon these posts, wires at stretched. I have used various kinds, but the last was number nineteen galvanized wire, which I am inclined to think will give me better satisfaction than anything else. The lower wire is placed twenty inches above the ground, a little higher than I used to put it, for the purpose of keeping the

grapes on the lower part of the trellis out of the dirt. A year ago this last autumn, there were heavy rains through the month of September, that spattered a great deal of soil upon the grapes, and it was very difficult to get it off. It troubled me so much that I decided that the lower wire should be raised to about twenty inches from the ground. The next wire I put fifteen inches above that. The next wire is fifteen inches above that, making four wires in all."

Another method is to secure a cross bar three or four feet long to the top of each post extending across the rows, with three or four wires stretched along on these cross bars to hold the permanent arms of the vine, the new growth and fruit hanging down from the wires. This mode saves the labor of tying, and the bearing shoots do better to hang down than to be trained upward. The posts should be at least six feet above the ground, and the wires should be stretched very tight. A wire trellis should be provided the second year of the growth of the vines.

**Culture and Pruning.**—The culture of grapes is very simple, being similar to that for Indian corn, except perhaps more shallow, so as not to disturb the roots. The harrow should be called into frequent requisition to keep the soil clean of weeds, and this can be best accomplished by destroying them as soon as they make their appearance and before they have had time to become established in the soil. The rules for grape culture must of course vary somewhat, according to the peculiarities of the climate, soil, the variety, exposure of land, etc. Frequent cultivation is a great benefit to grapes, as well as to other fruits. The object of pruning is to give a preponderance of roots over the top, and by cutting away the top of any plant that lives through the winter, we secure this object, so that the next season we shall have a stronger and more vigorous growth. There are various methods of pruning adopted. The usual custom is to allow but one cane to grow the first year, this being from the most thrifty and promising bud, all others being rubbed off early in the spring, or as soon as they are developed, all the sap and strength of the plant going to form one shoot.

Late in the fall this branch is cut back to three or four buds. The second two canes are allowed to grow from this stem, these being from the most vigorous buds, the others being rubbed off as before. By this means the canes grown receive a large portion of the sap and strength of the plant, and the roots have a fair chance for growth, superfluous vines not robbing them of their nutriment. During the following summer no pruning will be necessary, except to pinch off all inferior shoots. The following autumn the two canes are cut back to three or four buds each, leaving a bud upon the main stock to grow a cane the following year. The third summer, the two canes may be allowed to bear a *very* few clusters of fruit if desired, bnt if permitted to overbear when so young they will be liable to be permanently injured. The thinning of the fruit should be done with sharp scissors, instead of a knife. After the fourth year the vines can be trained in any style desired. Another method of training sometimes practiced is to permit two canes to grow during the second season as previously recommended, pruning them in the autumn at from three to four feet from the main stem, and fasten them horizontally along the lower railing or wire of the trellis.

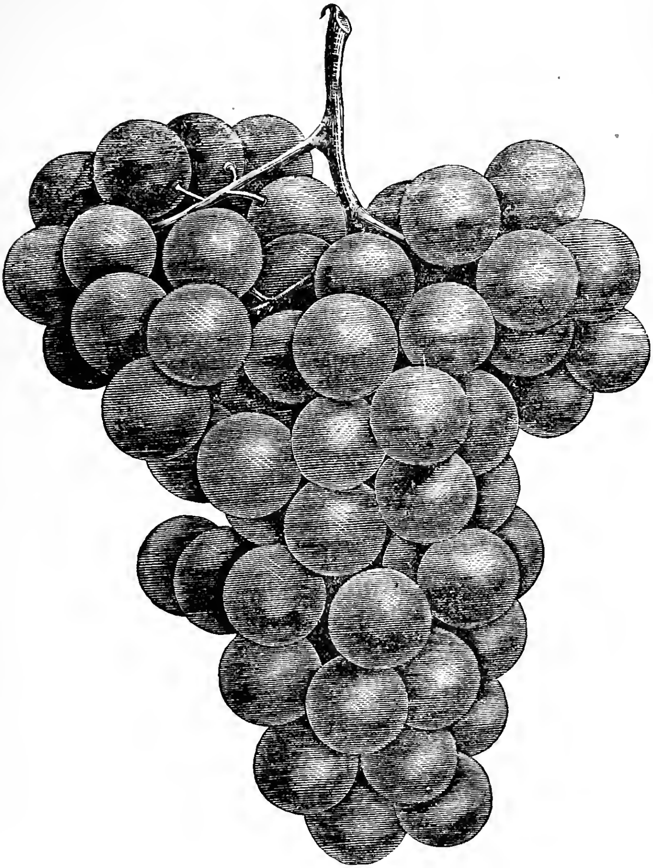
One bud is left to form an upright shoot about every foot of these canes, the others being rubbed off. Each fall or spring the laterals are all trimmed out, leaving only the two horizontal branches, and eight or ten upright. Two years from this growth, and every year afterward, each second or third upright cane may be cut back to within one bud of the main arms or branches, and thus new wood for fruit growth be constantly supplied. Another plan is to permit the vines to grow fan-shaped upon the trellis, renewing some of the canes occasionally by cutting them back. Another plan is to allow three or four upright canes to grow to a stake, cutting one or more of the canes back nearly to the ground occasionally to renew the wood, as only the new wood produces the fruit. The vine dresser must bear in mind that the object arrived at is to have the vine make the proper amount of new wood and

no more, for a good yield of fruit, and in pruning bearing vines, the old wood should be cut away and the new wood left, a few strong branches being left each year to provide a growth of canes for the next season.

When old vines that have not been systematically pruned are to be dealt with, the main canes should be left as long as space will allow, and each lateral or shoot pruned down to a single bud. When the vine starts in the spring, or after the vines have obtained sufficient strength to secure them against accident, the superfluous ones may be rubbed off, for several will be liable to start out, and if all are allowed to grow they will not be strong and vigorous, nor produce as good fruit as the well pruned vines. When the fruit has well set, the small, imperfect branches should be thinned out, by cutting them off with a pair of scissors; this will insure the growth of larger and more perfect branches of fruit, as well as fruit of a better quality than if all the branches were allowed to grow. About this time also, the bearing shoots should be pinched off about three leaves beyond the last bunch of grapes, so that there may be no surplus growth to take the sap of the vine from the growing fruit, the latter requiring it for its most perfect development. When the future bearing canes have attained a desired length, the ends should also be pinched off or shortened in. Young shoots from the roots or below the arms should be taken off as often as they appear, unless they are desired to renew the main arms. The best time for the general pruning of grape vines is when the sap is dormant, after the leaves fall in the autumn, since they are less liable to profuse "bleeding" than in the spring. When the larger branches bleed badly, grafting wax may be applied to check it. Summer pruning and care of grapes is a pleasant occupation, and is attended with but little labor. After several years' bearing, grapes are apt to deteriorate in flavor and size. The vines may be rejuvenated by cutting down the main horizontal shoots at the bottom of the trellis and permit new upright shoots to grow in their places, which will produce as fine fruit as the first vine.

**Hastening the Ripening of Late Varieties, etc.**—The time of ripening of late varieties like the Isabella and Catawba, may be considerably hastened by cutting off one-third to one-half of the clusters when they are small. When the fruit commences turning in color a few leaves that shade the clusters most may be removed, thus partially exposing them to the strong sunlight, but care should be exercised not to remove too many leaves. In sending to the city markets, grapes are generally packed in small paper boxes, or in baskets holding from six to ten pounds each. The principal expense in the cultivation of grapes is in the care of the vines, and gathering of the fruit, they requiring but little manure. The yield sometimes attains to four tons of grapes per acre, but such large products are apt to injure the vines, and it is better to limit it to about two tons per acre. The cost of cultivation, training, and gathering is generally averaged from $75 to $100 per acre, while the sales per acre will range from $125 to $600, according to the season, state of the market, variety, etc.

**Winter Protection of Vines.**—In very cold sections, many grape growers give the vines protection in winter. When this is done, they should be taken from the trellis before severe weather commences, and be laid upon the ground, fastened down with wooden pegs, and a layer of two or three inches of soil given them. Straw or fine boughs should be used instead of soil, where the earth is inclined to be too wet. Merely laying the vines upon the ground is generally thought to be better than to permit them to remain upon the trellis. Dr. Fisher expresses a different opinion, and says in this connection: "Grape vines grown in a proper manner will ripen the new wood as thoroughly as white oak will ripen its wood. The grape vine is just as hardy as the white oak. If it is not ripened, it will winter-kill. If it is ripened, it will not. If you overload the vine, if you attempt to grow so many grapes that you do not succeed in ripening the wood, it will winter-kill. I have not laid down a vine for five or six years, and I have not had a vine killed in that time, except one or two



THE BRIGHTON.
(Drawn from fruit grown by Mr. H. E. Hooker, Rochester, N. Y.)

that mildewed." Hardy vines that are kept well pruned and otherwise well cared for may not require winter protection, except in the very extreme limits of Northern culture; but varieties that are somewhat tender for the latitude should, we think, be covered.

**Grapes in Winter.** — With but little care some varieties of grapes possessing good keeping qualities may be kept till midwinter, or even late in the spring. As it is such a delicious and healthful fruit, the luxury of having it through the winter will well repay the trouble of properly storing it for this purpose. The Catawba, Diana, Isabella, Wilder, Vergennes, Iona, Clinton, etc. — such grapes as have a thick skin and are rich in quality — are the best for this purpose. Pick the fruit when perfectly ripe and dry, and place the bunches in a cool room for two or three days, where they will not be shriveled by the air being too dry, or moistened by its being too damp. Handle very carefully, always taking the bunches by the stems, and remove all bruised or loosened berries from each bunch, since such will soon decay and have a tendency to make the sound fruit decay also. Then place the bunches carefully between layers of wheat chaff, or maple or basswood sawdust that has been thoroughly dried, and put in a cold place. Sometimes rye straw or fine, soft hay, cut with a machine into one-half inch lengths, is used instead for layers. Cotton batting or soft paper is also frequently placed between the layers. The bunches should never be packed but three or four layers deep, as the fruit in the lower ones would otherwise be liable to be crushed by the weight of those above. Cover the top layers of fruit well, to exclude the air as much as possible. A fruit room cooled with ice is of course the best place to keep such fruit, but where this cannot be had the boxes or crates containing it may be placed upon the ice in the ice house, and covered with heavy blankets or a deep layer of dry sawdust. Care must be exercised that the fruit is not stored in such a way as to gather dampness, as it will then be liable to mould. Another plan is to pack the bunches in small paper boxes, or in shallow drawers in a cold room. where the fruit will not freeze, but be kept uniformly cold. Cellars are generally too damp for this purpose, but when sufficiently dry and cool they are excellent for storing grapes. Bunches cut with a portion of the vine attached, the ends of the vine sealed over with sealing or grafting wax, and placed in a cold, dry room, will keep for a long time. By simply placing the grapes in a moderately dry, cool room of even temperature, grapes can frequently be kept from four to eight weeks, according to the temperature and variety.

**Diseases and Insects.** — The *mildew* and *rot* are diseases with which the grape growers of this country have most to contend, while the principal insect enemies are the large yellow vine beetle and the grape-vine flea beetle, which are very destructive to the foliage and buds. For description and remedies see special department on this subject.

**Wine Making.** — Wine is most commonly made from the juice of the grape, although it may be made from the juice of any other fruit, such as blackberries, raspberries, currants. strawberries, etc. The following directions for making domestic wines from grapes will be found reliable and explicit. The amount of sugar may be varied according to the natural sweetness of the grapes; the amount herein indicated applies to such varieties as the Catawba and Isabella. Care should be used to have the grapes for wine *perfectly* ripe, for if not its quality will be greatly deteriorated.

Select perfectly ripe bunches, and then carefully pick off the stems and remove all grapes which are not quite ripe; the stems will injure the flavor. Squeeze the juice out, either by hand or press, strain through a hair sieve, and pour it at once into a clean, sweet barrel or keg, adding to the vessel two gallons of water for every gallon of juice made. At the same time put in four pounds of sifted sugar per gallon of juice. In adding the two gallons of water, let it strain through the pulp, skins, etc., of the residuum of the grapes, after being squeezed.

Fill the vessel full, up to the bung-hole, which cover with a sand-bag, to allow the fermentation to escape. Watch the barrel daily, and clean or scrape away the scum, which will be thrown out in large quantities. As the wine falls below the bung, fill up daily (after clearing away the scum) with sugar water, made with two pounds of sugar to the gallon of water.

The fermentation will continue from three to six weeks, according to the weather. When it has ceased, pour into the bung-hole about one gill of brandy to the gallon of juice, to flow over the surface and prevent its souring (the brandy may not, however, be indispensable). Then bung the vessel up tight. During the cold weather, in say the following February, when the wine is perfectly still and clear, draw it off into any other clean vessels; then quickly clean, scald, and rinse thoroughly the barrel in which the wine was made, and return the wine to it, bung it up, and draw it off as required for use.

If you wish to make a very palatable champagne, have the champagne bottles ready when you rack off the wine; put a tablespoonful of common syrup in each quart bottle; then fill with the wine, leaving about one and one-half inches space below the bottom of the cork, which fasten very securely with strong twine, as the pressure of the gas to escape is very great. The wine will improve by age, after the drawing off as above recommended. An old brandy or whisky barrel is the best for this purpose. Never use a new barrel, as the wine will taste of the wood. About fifteen pounds of grapes will give one gallon of juice. The riper the grapes, the better the yield of the juice. One gallon of grapes in bunches weighs about four and a half pounds. Keep the wine in the cellar, where it will not be exposed to extremes of temperature. An approximate estimate of the quantities required for a thirty-gallon barrel will be as follows:

*To Make Thirty Gallons of Wine.* — One hundred and fifty pounds grapes, yielding ten gallons juice; twenty gallons water, strained through the pulp residuum; forty pounds sifted sugar; two and a half pints common cider brandy. If carefully made, the wine will be wholesome and palatable, with a flavor like grape-juice Madeira. It is stated that wine made according to the above directions was preferred to all others at the Washington hospitals during the late war.

**Figs.** — The fig is a native of Asia and Africa, it properly belonging to a warm climate, although it may be raised in some portions of the Middle States with suitable care. In many of the Southern States it thrives quite well, producing fruit of excellent quality. The principal obstacle to its culture in the United States, however, is the cold of winter, which sometimes destroys, even in Florida, trees that are unprotected. On the Pacific coast the fig finds a more congenial climate. Figs can only be well ripened, and raised for preservation in a dried state, where the summer and autumn are warm and dry. The tree is remarkable in one respect, viz.: in producing fruit without its being preceded by any apparent blossom. There are, however, blossoms that are concealed in the interior of a fleshy receptacle, which is hollow, pear-shaped, and nearly closed, but which is lined throughout with a number of small flowers. Fresh figs are very sweet, being destitute of acidulous flavor, and, although greatly relished by some at first, are too sweet and cloying to be palatable to others, until they have acquired a taste for them. They are a very agreeable, wholesome, and nutritious food, and in warm climates are regarded as one of the favorite fruits. The tree grows somewhat in the form of a shrub, three or more stems sometimes growing from one root. It attains a height of from twelve to twenty feet, the limbs being stout and branching. It commonly produces two crops of fruit each year; but in Asia Minor, where the best figs of commerce are chiefly grown, three crops are frequently grown, the fruit of the third crop ripening after the leaves have fallen. The first crop, ripening towards the last of June, and the summer yield, which gives employment to a large population, comes to market in September and October

**Varieties.** — There are numerous varieties of figs, many of which are well adapted to this country, such as the LEEMAN, a large, bell-shaped fruit of a brownish yellow color, sweet and juicy; the CELESTIAL, a smaller, dark variety, less juicy, but more sweet than the former, and better adapted for drying; the BROWN TURKEY, a large, early, hardy variety, as well as an abundant bearer, skin dark brown covered with a thick blue bloom, flesh red and of delicious flavor; the BRUNSWICK, one of the largest and finest purple varieties. Other varieties might be mentioned as of fine qualities, such as the MALTA, BLACK ISCHIA, NERII, and WHITE ISCHIA.

**Cultivation, etc.** — The fig is generally propagated by cuttings, which are made eight or ten inches in length of the last year's shoots, with about half an inch of the old wood left at the base. The cuttings may be taken off in March, and planted in a light soil in a hot-bed, or early in April, in a shady place in the open air. The best soil for figs in this climate is a mellow, calcareous loam, of moderate depth, neither too wet nor too dry. If the soil is too moist, the tree will expend its force in the production of coarse wood, rather than fruit; while if too dry, the fruit will be liable to drop off before becoming fully ripened. The best manure is generally conceded to be a mild lime compost. In sections where there is a tendency to overgrowth of wood, root-pruning has been found very beneficial in promoting fruitfulness. Winter protection will be found beneficial to the fig tree in all sections where there is much frost.

**Oranges.** — The orange is a native of Asia, and is the most delicious fruit among the many varieties of the citrus family. The foliage of the tree is rich and aromatic, and its beautiful white blossoms surpass those of all other fruits in fragrance. Southern Europe, China, and the West Indies have furnished the largest supplies of oranges for the markets of the world, while within a few years past great interest has been awakened in Florida in the culture of this fruit. The portion of the United States best adapted to the production of oranges is Florida, together with a considerable portion of the States bordering on the Gulf of Mexico, and Southern California, many of the groves in some of these sections yielding as large and profitable crops as any in the world. The orange groves of St. Augustine and other portions of Florida are becoming quite noted for their excellent products. An orange tree will arrive at a bearing age in about eight years from the seed, or five years if grafted or budded on to the wild fruit. At eight years from seed they will, with good care, be from ten to twelve feet high. The bearing will of course be light at first, the product being increased year by year with proper care. Orange trees are long lived, and have been known to bear for more than a hundred years.

A tree in full bearing will produce annually from 2,000 to 10,000 oranges. From 48 to 100 trees are planted to the acre; the latter number, however, renders them too crowded. The wild orange is frequently used for grafting the better varieties upon, since the latter are thus made more hardy. In sections where there is much frost in winter, protection should be given the trees at that season, as the freezing and sudden thawing of the sap in the wood, thus rupturing the sap vessels, is very injurious to the trees. The orange is much more delicious when perfectly ripened upon the tree than when gathered before being fully ripened, as all of the oranges of commerce are, in order to bear transportation.

**Varieties.**—Among the varieties of orange most highly recommended by European authorities are TANGIERINE, a delicious early variety; the MANDARIN, somewhat larger than the former, but rather small, flattened, with a thin rind, flesh dark, orange colored, juicy and rich; a Chinese variety; the ST. MICHAEL, a small fruit, with pale yellow skin, thin rind, seedless, juicy, and sweet; it is considered by many the most delicious of all varieties. The MALTESE BLOOD, of medium size, blood red pulp, aud excellent flavor. The BERGAMOT; fruit pear-shaped and noted for a peculiarly delicious fragrance, from which perfumers obtain

their bergamot essence. The HAVANA, a sweet orange of fine quality; the ST. AUGUSTINE, a large variety of the Havana, and superior to it in quality. The orange of PORTUGAL, or common sweet orange, is a tree growing to a great height; the fruit is ordinarily round, sometimes flattened, and occasionally a little oblong; rind reddish yellow, and aromatic, flesh sweet and juicy.

The CHINA orange is one of the most delicious of all varieties, being exceedingly sweet, juicy, of delicious flavor, and highly aromatic. The skin is smooth, glossy, and thin. Gallesia thus describes the RED FRUITED ORANGE: "It is a singular variety. Its appearance, its leaf and flowers are all exactly like the common orange. Its fruit alone is distinguished by a color of blood, which develops itself gradually and like flakes. When the fruit begins to ripen it is like other oranges; little by little spots of blood-color appear in its pulp; as it advances to maturity, these enlarge, becoming deeper, and finally embrace all the pulp and spread to the skin, which is, however, but rarely covered by the peculiar color; yet this sometimes occurs, if oranges are left on the trees after the month of May. This orange is multiplied only by grafts, having few seeds, and those of little value. Its branches are without thorns, its fruit sweet, but less so than the China orange, and it has a thicker skin."

Mr. T. W. Moore, of Florida, one of the best authorities on the culture of this fruit in the orange-growing section, says respecting the varieties cultivated in the Southern States:

"Almost every community where the orange has been long grown from seed, has some excellent and well-marked variety. Some of these varieties vary greatly. Some ripen early, and others late. Some have thick, tough skins with finely-flavored fruit and well adapted to shipping a long distance, while others are of such a delicate skin and pulp, they will have to be eaten nearer home. Some are large and light bearers, while others are small and heavy bearers.

Many varieties differ in color, from the pale orange to a reddish orange, and even to blood color. It would be well for those who intend planting budded trees, or propose budding trees now growing, to select the most excellent kind, whether they have yet been honored with a name or not, as it is the *quality* of the fruit and not the name which is needed. The name and classification will come in time. Any new and remarkably good varieties ought also to be brought to the notice of the State committee, above named, on nomenclature. These gentlemen will do their duty, and Florida will be compelled to have her own nomenclature, as she has her own varieties. The orange of Portugal and the China orange are two well known varieties in Europe, and are frequently seen in Florida, but have changed somewhat by having been reproduced from seed.

So far, the Florida Fruit Growers' Association has determined through its committee the nomenclature of our own varieties." The following are some of the varieties mentioned: The TANGIERINE (previously described), DANCY'S TANGIERINE, in flavor and external appearance superior to the original. Seminal variety of the Tangierine raised by Col. F. L. Dancy, Buena Vista, St. John's county, Fla. NAVAL ORANGE.—Size large to very large, eye presenting an umbilical appearance, stem inserted in a shallow-ribbed cavity, with deep lines; flesh very fine, melting, and tender, juice sweet, sprightly, vinous, and aromatic; quality first; origin, Bahia, Brazil. SWEET SEVILLE (Hick's), size small, slightly flattened, color deep, eye small, without depression; skin very smooth, grain very fine, juicy, and melting; juice very sweet and sprightly; quality best; a superior fruit in every respect except size. Supposed to be a seedling raised at Arcadia, St. John's Co., Florida. ARCADIA, size large, form somewhat flattened, color deep, skin smooth, color of flesh deep, grain rather coarse, juice slightly sub-acid, quality good. Supposed seedling raised at Arcadia, Florida. NONPAREIL, size medium, grain fair; pulp melting, sub-acid, and vinous; quality good. Seedling raised by Mrs. Mary Richards, Duval Co., Florida. MAGNUM BONUM.—Size large to very large, color light, grain fine, juice sweet, rich, and vinous; quality best, and seedling raised at Homossara, Florida.

BUENA VISTA.—Size medium, color dark crimson, color of flesh very dark, pulp coarse but melting; juice sub-acid, sprightly. with vinous flavor; quality good. Doubtless new and improved varieties of the orange will be introduced from time to time. the same as with other fruits, as its cultivation is becoming rapidly extended, and the interest in it is constantly increasing in those sections best adaped to its growth.

**How to Plant an Orange Grove.**—The following directions for planting an orange grove, its cultivation, etc., are given by Mr. T. W. Moore, of Florida, who has been engaged in successful orange culture for many years. and to whom previous reference has been made. The several methods are, first, the budding of the wild sour trees without moving them; 2d, budding them first and planting afterwards in some suitable location; 3d, planting the sour stumps and budding afterwards; 4th. growing the trees from sweet seed without budding; 5th; planting the sweet seedling and budding either before or after removal from nursery; and 7th, a grove of sweet seedlings.

Each of these plans has some advantages over the others. They all have advocates; but which of all has the greatest number of advantages is questionable. I have tried them all, but after stating the advantages of each, must leave to the grower to select for himself as circumstances and inclination may control. If one is impatient for return, let him choose the sour grove, if he can find it, and bud the trees where they stand. With proper management he may begin to gather in two years. If he is still impatient, but cannot find a sour grove, let him buy the sour stumps, plant them in some suitable location. and he may begin to gather fruit in three years from planting. But if he can wait awhile longer for fruit with the hope of getting a longer lived tree and more abundant yield let him plant *younger* trees, either seedlings or budded stock. If he wishes an early bearer and comparatively smaller tree. he can select the *sour* seedling budded. If a larger but later bearer, he can select the *sweet* seedling budded. If he wishes an abundant yield and the largest trees, and can wait a longer time, the sweet seedling, unbudded, will suit. With good treatment such trees will begin to yield in eight years, and, after a longer time, in ninety-nine cases out of a hundred. give him a fair quality of fruit; but perhaps he will have as many varieties or sub-varieties as trees in his grove. The sour stock for a few years grows more rapidly, but will finally make a smaller tree than the sweet. The best quality of fruit can be insured only by budding from the best varieties.

Special reference should be had to drainage, soil, water protection, forest protection, proximity to fertilizers, and facilities for transportation. The soil for a grove should be thoroughly drained, either naturally or artificially. Not only should the surface water be carried off, but the drainage should be so deep as to allow roots, and especially the tap root, to penetrate for several feet. Some think that less than ten feet is not sufficient But there are in this State groves of fine old trees and good bearers with considerable less than ten feet of drained soil. The sour stock will flourish on a much wetter soil than the sweet. And it may be that these groves that have long done well in such localities are sour stocks budded. Where choice of location can be made, and especially if sweet stocks are to be planted, select a soil well drained by nature. Art and labor can accomplish a great deal, but it costs something. and the effect is not so permanent as when nature has done the work. If no positive evil arise from a wet subsoil in close proximity to the surface. still there are reasons why a deep, dry, or moist soil is better. While it is true that the principal feeders of the orange lie near the surface, yet whoever will take the pains to examine the roots of an old orange tree grown in a deep and well-drained subsoil will find that these roots have penetrated for many feet deep into the earth, and in all directions from the tree. Now if trees have been set twenty feet apart in the grove. and the soil is drained but one foot deep, the roots of each tree have but four hundred cubic feet of soil in which to feed. But if the soil has been drained to the depth of ten feet, then the feeding ground for the roots has been increased

ten fold, and instead of four hundred cubic feet of soil in which to feed, the tree has four thousand cubic feet. This advantage is more especially to be considered where the subsoil is sandy, as in such a soil, air and other nutriment for the roots penetrate to a greater depth. But there are some of these wet soils found in our State that are positively poisonous to the orange, as they contain a large per centum of salt—*chloride of sodium.*

The orange will grow in a variety of soils—in clayey, sandy, shelly, or loamy soils; in hummocks black or gray, on pine lands, or black-jack ridges. It does well on soil underlaid with clay or sand. It will even do well on a light soil underlaid with white sand if fertilizers are annually applied. But whoever wishes to plant an orange grove should be careful to select the best available soil. Perhaps the poorest soil suitable for orange growing is that underlaid with a white sand, as such a soil leaches very readily the soluble manure. Perhaps the best soil is found in our dark gray hummock, with deep soil underlaid with a yellow clay or yellow sand subsoil.

The natural growth should be tall and large, with an abundance of live oak and hickory, as such a growth would indicate an abundance of lime. Of our pine land that on which the hickory is found mixed with the pine, with yellow subsoil, should rank first. Such a soil is really a mixed hummock and pine. Next to this is the pine mixed with willow, oak, and black-jack. Considering the ease with which such lands as the last two classes are cleared and planted, the readiness with which the orange grows on them, they deserve a high rank, and especially if fertilizers are close at hand. In selecting a location in the purely pine lands, select that which is thickly set with tall trees, well drained, and with a yellow sub-soil. Such soils, if occasionally dressed with alkaline manures, grow the orange admirably.

While with proper care the orange may be grown successfully in almost any portion of the State of Florida, still it is wise to select a location which may combine all conditions favorable to the best results. In budding, but one plan, that of inserting a single bud, is practiced. The graft has not done well. Grafted trees will live, but they do not grow so thriftily as the budded tree. Grafting is sometimes resorted to when one wishes to preserve a new variety and he has obtained a cutting of this new variety in winter when the sap is not in condition for budding.

**Transplanting.**—Before the work of transplanting begins, the soil for the grove should be well prepared. It is most generally the case that the great hurry to get the trees into the ground causes much neglect at this point, but this policy is a bad one. The haste should have reference to the early fruiting and rapid growth of the tree; and they are not brought about by careless preparation of the soil. The soil should be deeply and thoroughly broken, and the ground cleared of the roots. To insure the setting of the trees a proper and uniform depth, the ground should be well leveled with a harrow or drag. No manure should be used at the time of setting, nor before, unless applied some months previous, and thoroughly incorporated with the soil.

The best time for setting trees is the late winter or early spring before the new wood has started. The ground is then cool and the roots in as dormant condition as at any time during the year. It is better that the ground should be wet and the setting followed by showers. But wet soil is not so essential at this time of the year as it is when the transplanting has been done later and the ground and sun are warmer. Where trees are to be set under forest protection so that they will escape any damage from frost, the late fall is the best time, as trees set at that time are well established and ready to start by the spring.

In taking up the trees great care should be taken to prevent breaking or bruising the roots. As many roots as possible should be taken up. If the distance from the nursery to the site of the grove be short, and the nursery rows have been well manured with muck, and the ground is wet at the time of lifting the trees from the nursery, much of the soil can be taken along with the roots. Immediately on lifting the roots from the ground they should be

trimmed with a sharp knife wherever they are found to have been bruised or broken. The lower part of the tap-root also should be cut off to prevent its doubling up on being reset. Twelve or eighteen inches is sufficiently long for the tap-root. Put the tree under shade and cover the roots with wet moss as soon as possible. Do not allow the fibrous roots to dry, as they are very delicate and soon perish. Keep them protected up to the moment of setting, taking but one tree at a time from its covering of moss. To insure still further against damage to the tender roots, have on hand a half barrel of muck made into a thin paste, and as fast as the trees are lifted and the roots trimmed, plunge the roots into this paste, take them out and wrap in moss.

The holes for the trees should be freshly dug. The work of setting is easily and rapidly done by three hands working together — one to dig the holes, one to prune and set the tree, and a third to fill in. The holes should be dug in the shape of an inverted saucer or truncated cone with about two inches of the top cut off. Proceed thus: Around the stake which marks the place for the tap-root, with a shovel or hoe take away the soil, letting the tool strike the top of the soil at the stake and continue to dig deeper into the soil until at a distance of eighteen inches from the stake it has penetrated six inches below the surface. Proceed thus around the stake until it is completed. This gives the greatest depth of the hole on the outer edge, or perimeter of the circle. Now take up the stake, cut two inches of the top off the cone. Where the stake stood, push down with the spade by working it back and forth until it has penetrated the ground about eighteen inches, or the full length of the tap-root of the tree to be set. Now insert the tap-root in this hole made by the spade. Be careful not to set the tree deeper than it grew in the nursery. With the hand pack the soil firmly around the tap-root. Next spread the lateral roots over the cone, taking care to distribute them evenly over the cone. Throw on two inches of dirt and press it firmly with the feet. Finish by throwing in soil and leveling the ground, leaving the last layer of soil untrod.

Before the tree is left it should be trimmed with shears in proportion to the trimming done to the roots. If planting is done in summer or in hot weather and the ground is not protected by forest trees it is better to mulch. If the trees are older than three years, and wild grown, it may be necessary to dig the hole deeper than directed above, but the point of this caution is against deep setting. The writer is satisfied that more trees have been diseased and retarded in their growth and frequently killed by deep setting than by any other one cause.

The distance apart that the trees should be set will depend upon the character of the trees. The seedling should have the greatest distance, the sweet seedling budded less, and the sour stock budded least of all. Where land is laid off in squares the following table will give the number of trees that will stand on an acre:

| Distance apart. | No. of trees in squares. | No. of trees in diamond. |
|---|---|---|
| $15 \times 15$ | 164 | 180 |
| $18 \times 18$ | 114 | 125 |
| $20 \times 20$ | 90 | 99 |
| $21 \times 21$ | 81 | 89 |
| $25 \times 25$ | 53 | 58 |
| $30 \times 30$ | 36 | 39 |

**Cultivation.** — The orange will live with almost no cultivation, but it will only be a sickly existence. We know no plant, shrub, or tree, that will pay better for good cultivation; none that will respond so certainly to thorough cultivation. The ground in the grove should be kept level; the surface light. As far as the roots have extended the surface should not be stirred deeper than three inches. The more frequently it is stirred, the better. Beyond the reach of the roots it is well to cultivate deeply and frequently, but as the roots extend them-

selves this area of deep cultivation should be lessened. After the roots have extended themselves well over the ground, the best plow to be used is the sweep. A single thirty-two inch sweep, or a gang plow, the middle or front plow twenty-two inches wide, and the two side plows, fourteen inches each, does excellent work. It is better than the turning plow or cultivator. The sweep is much more uniform in the depth of its cutting than either. It is much more rapid in its work than the single plow. It is more apt to cut off the weeds below the surface and destroy them, than the cultivator. With such an implement, a grove free from stumps and litter is easily and cheaply kept in fine condition.

While the orange trees are young, it is of advantage to keep the ground planted in garden crops — peas, beans, potatoes, tomatoes, anything that requires frequent work and will mature within a few weeks, partially shading the ground. Of course nothing should be taken from the ground without making adequate return in the form of manures.

Where the trees are planted far apart and ten or twelve years will elapse before the ground will be all occupied by the orange, grapes and peaches will do well and prove profitable, provided the soil is well drained. At no time should the roots of grass and weeds be allowed to mat themselves on land growing the orange. Not only will they draw heavily upon the soil while they are growing, but when turned over the turf and matted roots will necessarily leave the surface very irregular, causing the ground to dry rapidly under the influence of the sun and wind.

In cultivating the grove with the plow there is a constant tendency of the soil to pile up around the trunk of the tree. This should be watched, and if the crown of the lateral surface roots is a half inch below the surface, from this or from deep planting, the soil should be drawn from around the trunk till the upper sides of these roots are brought to the top of the ground. If the upper parts of these roots are left bare, for one or two inches, where trees are five or six years old, and for a greater distance where the trees are older, these roots develop very rapidly and not only furnish stout braces to the trunk, but great arteries for conveying life and food from the soil.

**Pruning.** — Do the principal pruning in the spring. By all means avoid fall or winter pruning, as it is apt to start new wood at a time when it is most exposed to damage from frost. Cut off all dead wood, and up to, or a little into the living wood. Thereby the wound heals more readily. As a general rule, cut off all diseased branches; especially if they have become so far diseased as to fail to develop healthy leaves. Do not trim up the trunk too high. Encourage the lower branches to extend themselves well around the trunk and far over the surface of the ground. If they do not touch the ground they are not too low. As the tree grows these branches will continue to droop nearer the ground until the lowest may have to be cut off after a while; but this late cutting off is much better than to have the trunk exposed either to sun or cold.

Give and keep an open head to the tree. To do this, select the most vigorous lateral branches, leaving some on all sides of the tree so as to obtain a head as uniformly balanced as possible. After cutting off the other branches close to the trunk, trim up these selected branches almost to a point, leaving only a few of the terminal smaller branches. When this is done the tree will look like a skeleton, and you will likely conclude you have used the knife too freely. But if this pruning has been done in the spring and you keep the 'water' shoots pulled off the trunk, and cultivate well, you will find the trunk by winter enclosed by a beautiful head with a dense wall of foliage on the outside. The next spring trim these laterals in a similar manner, allowing the first laterals to rebranch a little distance from the trunk so as to be able to fill up the larger area by fall. Continue this method till your tree is large enough to bear its first crop. You can then slacken your pruning so as to encourage the fruiting.

**Fertilizers.**—It is not safe to manure trees at the time of planting. In some instances this has succeeded very well, but only when the manure has been long composted and frequently turned, so that no fermentation will occur around the wounded roots. When manuring must be done thus early it is better to scatter it on the ground and turn it several times in the soil some weeks before the tree is planted. After the tree has been planted and once started to grow it is then well to manure it heavily till it begins to bear. Begin with a moderate quantity, applying nearer the outer extremity of the lateral roots and increase the quantity every year and enlarge the area to which it is applied. Orange trees should never be stimulated in the fall or latter part of the summer. It is much better to manure in the spring. Another advantage to be noted is, when trees are pushed before coming into bearing, the heavy manuring does no damage to the fruit. After trees have begun to bear it is better to manure heavily once in four or five years.

Manuring bearing trees, and especially when the manuring is heavily done, has a tendency to make the oranges split and drop off the first year after manuring; and even when they do not split, the fruit for the first year is not so sweet and is more liable to rot soon after picking. To insure a good general yield and salable fruit each year the manuring should be applied alternately to different parts of the grove, laying off the grove into four or five equal parts and manuring the first part the first year, the second, the second year, etc. The kind of fertilizer to be used depends largely upon the character of the soil.

Some of the commercial manures are valuable when used in combination with other things, but none of them contain in right proportions all the elements needed for the orange. A good article of ground bone, where the oils and phosphoric acid have been too generally expelled by burning; Peruvian guano, and potash, both the nitrate and sulphate, are very good when combined with muck. These are especially valuable when early vegetables are to be grown among the orange trees, as they highly stimulate the soil and hasten forward both the vegetables and the orange trees. Land plaster should be especially mentioned as beneficial to our sandy soil, as it not only furnishes an important element to the soil, but in the absence of clay in most of our soils, furnishes a valuable absorber and retainer of the volatile manures so easily expelled by our abundance of sunshine. The writer thinks he has seen another advantage in the use of land plaster in the check which the sulphur, contained in the plaster, has upon some of the insects which damage the trees. Green crops turned under are highly beneficial to young trees. Rye, oats, and barley sown in the fall and turned under in the spring, and followed by one or two crops of cow peas during the summer help forward a grove of trees wonderfully. It is still better if this be accompanied by a liberal dressing of wood-ashes. One ton to the acre is not too much. Manures from the stables, cow-pens, hennery, and pig-sty, indeed from every place where waste is deposited, should first be deodorized by the liberal use of land plaster or sulphate of iron—copperas—dissolved in water and composted with muck, and be carefully saved and utilized. As they are highly stimulating they should be composted with three or four times the quantity of muck, and frequently turned before using.

But of all the manures, that which is cheapest and most abundant is the muck to be found in our rivers, creeks, lakes, and ponds. Before trees reach the bearing state they should be fed with nitrogenous manures; but after they have begun to bear, potash and kindred manures should be liberally used. Nitrogenous manures encourage the development of new wood foliage, while lime and potash are necessary to an abundance of fruit. The yellow leaves of the tree indicate a deficiency of nitrogenons manures, while the dark green leaves show an abundance. On the other hand rust on fruit shows an excess of nitrogenous manures, and the writer has found a correction of this in using the slacked lime from burned oyster shells sown broadcast. The lime, in sowing, should be allowed to sift lightly through the branches and leaves of the tree. It should be applied before the trees bloom and when the foliage is dry.

**Gathering and Packing for Market.**—In gathering, cut the stem, leaving half an inch of stem on the orange. Place the different varieties in heaps by themselves. Cover lightly with straw for three or four days, the longer time during cold weather and the shorter time during warm weather, that the oranges may sweat. After this time place them in latticed bins, holding from one to two hundred oranges each, to dry. In putting them into bins assort them with reference to size, color, and perfection, so that the classification may be complete. They can now be packed at leisure, for after they have been dried out without being bruised they will keep indefinitely. The boxes for packing should be of light material, neatly made, tolerably close, and hooped. Dimensions $8 \times 16 \times 27$ with partition in the middle. In making these one side should be left open. In packing the open side should be turned up, and the box lined with sheets of paper laid on the bottom and resting against the side. Each orange should be wrapped separately in tissue paper containing as little oil as possible, so that it will readily absorb and throw off moisture.

The wrapper should be careful to reject every bruised or otherwise injured orange. The packer should be careful not to put different varieties in the same box. The buyer should know when he has tasted any orange from a box or brand that all others of the same brand or box are its equal. In packing, the oranges should be placed closely together in layers, so that there can be no rolling or sliding of the fruit in the box. The last layer should project three-fourths of an inch above the sides of the box, so that the top when nailed on should hold the layers firmly to their places, even after there has been some shrinkage to the fruit. This is all-important when the fruit has to be transported a considerable distance; and especially when transported by rail. The box should now be marked with the number of oranges and the brand of fruit.

**Diseases and Insect Enemies of the Orange.**—The orange has comparatively few diseases or insect enemies. One of the most formidable diseases is the dying back of the new wood to the old, sometimes confined to a few branches of a tree, and sometimes embracing nearly all of them. This is frequently caused by the sting of an insect to the new wood, or it may originate near the roots. Deep planting will produce such symptoms. We have occasionally dug up trees so afflicted and found them wanting in new roots. The remedy is to reset, or else take away the top soil till the lateral roots are brought near the surface, and to keep the soil well cultivated. The better plan is to take them up and reset them. Cut away all diseased wood and roots. When the extremities of roots of trees come in contact with poisonous earth a similar symptom is produced, as in planting upon hard-pan or over a stratum of salt earth.

**Rust** on the orange (fruit) has been a considerable cause of annoyance to some growers, because it mars the beauty of the fruit, though it does not affect its sweetness, nor its flavor. It is a disease confined exclusively to the outer skin. Whether it is a true rust, or is simply an absence of the essential oil so abundant in the peel of the yellow fruit, the writer is not fully satisfied, though inclining to the latter opinion. Fruit so affected has one advantage. It keeps longer than that enveloped in the lighter and more oily skin. The writer has had no difficulty in removing this disease. At different times and on different trees he has changed, in a single year, the color of the fruit from a dark-brown to a bright-yellow and smooth skin, by the application of slacked lime from oyster shells, as before noticed. Whether the lime acts as a corrective of disease, or whether its presence was needed in the soil for the perfecting of the fruit, or whether it absorbed carbonic acid and so furnished the additional amount of carbon necessary for the manufacture of the essential oil by the tree, the writer knows not. But the fact of benefit is not doubted.

Where moss appears on the trunks of trees, it is easily removed by any alkali wash. Soap suds, or what is better, wood ashes, will both fertilize and cleanse. The cracking of the

fruit is occasioned by any suspension of the growth of the fruit, and a consequent hardening of the rind followed by a sudden flow of sap from any stimulating cause, as highly fertilizing a bearing grove, especially during summer, or a wet spell following a dry. The cracking is more apt to follow the rains, if trees have been highly manured even in winter. This can be prevented by keeping the ground well stirred during dry weather. The soil thus stirred, absorbs moisture and keeps the fruit growing.

**Insects.**—The insect which was at one time considered the most injurious, was the long scale insect, resembling one side of a distorted mussel shell, and was called by Packard, *Aspidiotus Gloverii.* When it first made its appearance in Florida, it threatened universal destruction of the orange groves. Several remedies have been found effectual. The most effective yet known to the writer is a decoction of tobacco with sufficient carbolic soap to make a strong suds. Apply with a garden syringe or pump, through a perforated nozzle. Kerosene, in the proportion of one part of kerosene to eleven of water, applied in the same manner, is effective. But there is danger if too much be used. A moderate amount is a good fertilizer and stimulant to the tree. As there is no chemical affinity between the kerosene and water, the mixture has to be kept vigorously stirred during the time of applying it. Either of these applications has to be repeated two or three times at intervals of ten or twelve days.

The wood louse, or white ant, has occasioned serious trouble, and sometimes death to many fine young trees where the preventative was not used—ashes or slacked lime around the base of the trunk. When a tree begins suddenly to show yellow leaves examine a few inches below the surface at the base of the trunk for wood lice, especially if a stake has been driven near the trees for its support, or if litter from the forest or mulching of leaves has been used. If wood lice are discovered clear them away carefully, pour boiling water into the cavity around the tree until all the cavities in which the lice could have concealed themselves have been reached. If the tree has been but partially girdled it will recover, if the soil be placed above the wounded part. But if the tree has been completely girdled, get well rotted muck and pile it for three or four inches above the wound, and cover over with sand. Finish with a top-dressing of fresh wood ashes or slacked lime. If the tree is not too far spent, it will send out young roots above the wound and finally recover.

Two other insects damaging to orange trees are to be noticed. These insects are very dissimilar in appearance, but the injury done by them very similar. One insect is a spider with a long, slender body. When at rest its fore legs extend forward, and the hind legs backward, and all parallel with the body, which clings closely to the branch or leaf on which the insect rests. I am fully satisfied that it is the cause of one of the forms of the disease known as the die-back. Early in the morning the insect is usually found on the tenderest shoots of the orange, and wherever found the indications are the same. If the shoot is very young and tender, it begins at once to lose its freshness, and ceases to grow; a little later it assumes a rusty appearance, and finally dies. If the shoot is a little older when attacked, or if the insect has moved lower down, after exhausting the extremity of the shoot, and attacks the stronger wood, a blister appears on the bark, and, if examined, a collection of sap is found just under the puncture made by the insect, and between the bark and the wood. The sap soon hardens into a gum. If the sap is flowing very vigorously at the time the bark is punctured, a little sap flows from the puncture and hardens into gum. The branch is evidently poisoned by their operations, and frequently dies down to the wood of the previous growth. If the tree is abandoned to the insect, the young wood is soon all killed.

The other insect to be noticed resembles the squash bug, and is called by the entomologist of the Department of Agriculture, *Euthoctha galeator.* These insects are very bold in their attacks. I have watched them frequently in their operations as they were lying in the hot sun basking, while their probosces were inserted in the tender shoots. I have held my mag-

THE SHARPLESS SEEDLING.

nifying glass within a half or three-quarters of an inch from them, and had the finest opportunity of observing the operations of this bold enemy of the orange. I have seen the tender shoots wilt, when the insect was sucking them, from the extremity to the point at which this insect had inserted its proboscis. As this insect is larger than the spider, the injury inflicted by it is much more speedy. But when the shoot is older and more vigorous, the effect is very similar to that produced by the spider.

As no natural enemies to either of these insects are known, watchfulness on the part of the orange grower is alone to be relied upon for their destruction. They should be caught by hand, or in a net, and killed. The insect last described is very apt to conceal itself under litter during the winter. Pieces of bark, boards, logs, stumps, litter of every kind offer them shelter. In early spring, when the weather is cold, everything of the kind in the vicinity of the orange grove infested should be burned. The insect is very fond of sucking the cow-pea, and lays its eggs near its field of operation, often on the under side of the leaf of the plant on which it feeds. If the orange grower will grow cow-peas in his grove, and bury them in trenches or holes dug at the extremity of the orange roots, a few days after these insects have commenced to feed upon the peas he can destroy them at a most important time. Both these plans were adopted by the writer during the present year, and his grove is now quite clear of this pest.

When trees have been damaged seriously by either of these insects, the knife and saw must be freely used. Cut away all diseased wood. Let the cutting be so heavy that the tree will start strong shoots. Watch these young shoots carefully, in the early morning, for the spider, and, when the sun is warm, for the bug resembling the squash bug. Kill all that make their appearance. If the extremities of the shoots have been stung, pinch them back. They cannot be saved if the wood is very tender. If blisters appear in the harder wood, puncture them with a knife. It will relieve the wood, which will readily heal, and the branch will soon recover its vigor.

**Lemons.** — The lemon belongs to the *Citrus* family, and resembles the orange in general appearance, although it does not form the close head of deep green foliage that characterizes the latter, the leaves being paler in color, more sparse, with translucent dots seen when held between the eye and the light, these dots being oil glands that give them their fine aroma It is not as hardy as the orange, but requires similar culture. Wherever it will succeed, its culture is exceedingly profitable.

**Limes.** — The lime differs from the lemon by its smaller flowers and fruit, while the juice, although quite sharp, is not quite as rich as that of the lemon. It also grows upon a small, dwarfish tree or shrub, and is a native of Asia. Limes are cultivated in nearly all warm regions, the culture being similar to that of the lemon.

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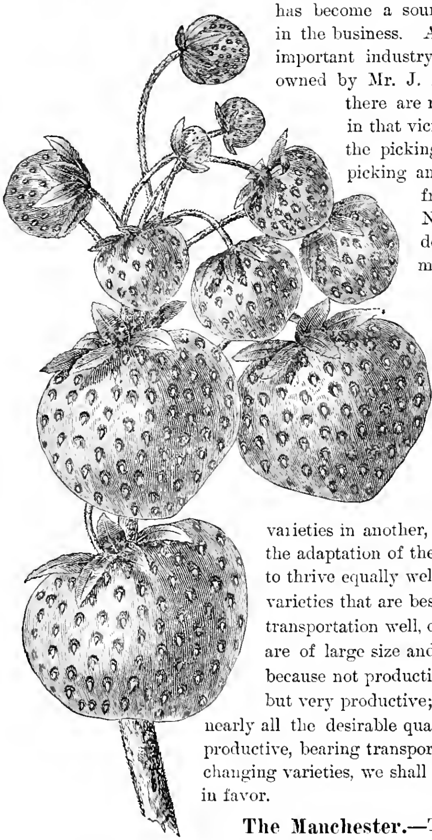
## SMALL FRUITS.

**STRAWBERRIES.** — The strawberry is the most delicious and wholesome, as well as the most extensively cultivated of all berries, it being found in this country from Maine to Texas, and in California and other States on the Pacific coast. It may be said to be almost universally grown, it being a native of the temperate latitudes of both hemispheres, and found in Europe, Asia, North and South America. The species, however, that are found in different portions of the world differ in many respects, cultivation having resulted in producing different classes of fruit. The name of this berry is said to have had its origin from the common practice of placing straw between the plants in cultivating, in

order to keep the fruit free from contact with the soil. Some writer has said that "the Creator could probably have made a better berry than the strawberry, but the fact is He *never did*," an opinion in which the majority of people will doubtless concur. It is a luxury that should be enjoyed by every household in sections in which it will thrive, while the ease with which it may be grown, and its adaptation to widely different soils and temperatures, enables those possessing even the smallest garden patch to have strawberries of their own cultivation, if they desire. A plot of only twenty or thirty feet square, set to plants and well cared for, will furnish a supply of berries that would surprise those not accustomed to cultivating them.

Great improvement has been made in the production of this fruit during the last few years, not only in originating new and superior varieties, in improved methods of cultivation, but in greatly extending its culture, which in some sections has attained vast proportions, and has become a source of great revenue to those engaged in the business. At the South especially has it become an important industry. A strawberry field of 140 acres is owned by Mr. J. M. Samuels, near Jackson, Tenn., and there are many other large strawberry plantations in that vicinity. It is stated that in one day in the picking season 525 hands were employed in picking and shipping 26,000 quarts of berries from that one field. In the vicinity of Norfolk is a plantation of 250 acres devoted to strawberry culture. Thus many of the Southern States furnish enormous supplies of this delicious fruit to the great markets of the North and West, and the demand for it and the supply is yearly increasing.


MANCHESTER.

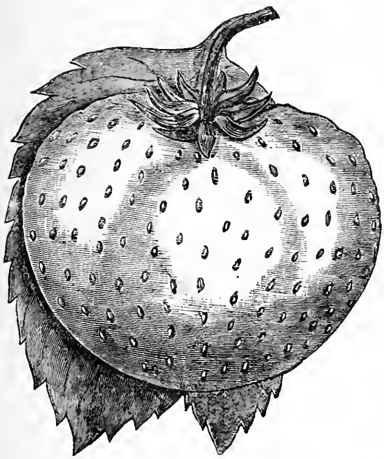
**Varieties.**—The varieties of the strawberry are very numerous, and the number is constantly increasing. As with all other fruits, some varieties give the most satisfactory results in one section, other varieties in another, according to the soil and climate and the adaptation of the plants to each, while some kinds seem to thrive equally well in all sections. Then there are some varieties that are best suited to home use, they not bearing transportation well, others that are quite the reverse. Some are of large size and excellent flavor, but are not profitable because not productive; others that are of inferior quality, but very productive; and others still that seem to combine nearly all the desirable qualities, being of excellent quality, hardy, productive, bearing transportation well, etc. Owing to the constantly changing varieties, we shall describe but a few of those now most in favor.

**The Manchester.**—This variety originated from a chance seedling found in Ocean County, N. Y. The plant is a strong, rapid grower, hardy, and very productive. The fruit is quite large in size,

form oblate-conical, color a light scarlet; flavor good. The cut of this specimen was made from a photograph of berries grown by Messrs. G. H. and J. H. Hale of South Glastonbury, Conn., and represents the natural size of the fruit.

**The Wilson** is an old and popular variety, raised from seed by M. J. Wilson, of Albany, N. Y. It is not of so desirable a quality as some others, owing to its being quite acid; yet it is very hardy, vigorous, and productive, and for this reason has been perhaps more extensively cultivated in the past than any other single variety. It commences to ripen early, and continues late. The fruit is large, color deep crimson, flesh crimson, tender, with a brisk acid flavor.

**The Crescent Seedling.**—This variety originated with Mr. William Parmelee, of New Haven, Conn. It is hardy, very vigorous, and productive, ripens early, and continues late. The plants require considerable space to do well. The fruit is of medium size, roundish in form, bright scarlet, fair flavor; flesh moderately firm. The plant requires less attention than most varieties.



CUMBERLAND TRIUMPH.

**Cumberland Triumph.**—This is a large fine berry, that had its origin in Carlisle, Pa. The plant has dark green leaves, and is a vigorous grower, but unfortunately not a prolific bearer. It is a fine variety for family use, but is too soft to bear transportation well.

**Charles Downing.**—For some time past this berry has been regarded as one of the best for home use or near market; but of late it seems to be easily affected by rust or leaf blight in some sections. The plant is very productive, the berries quite large, conical, nearly regular, deep scarlet; flesh rather firm, pink, fine flavored, sweet, and juicy.

**The Bidwell** is an early berry with fruit of medium size, sometimes, in rich soil, quite large; form round conical and long conical, with a slight neck; color bright crimson, with light red flesh, firm and juicy, slightly sub-acid. It is a Michigan seedling, and a good variety for either family use or market.

**President Wilder** was produced by Hon. Marshall P. Wilder in 1860, from the Hovey Seedling impregnated with the La Constante, and was dedicated to him by the Massachusetts Horticultural Society. The plant is healthy, hardy, vigorous, and very productive. The first stalks are short, stout, and erect. The fruit is quite large, in form roundish, obtuse, conical; color bright crimson scarlet. Flesh whitish, quite firm, juicy, sweet, and rich. There is another variety called President Wilder that originated in Europe, which is described as large, deep crimson, and of excellent quality.

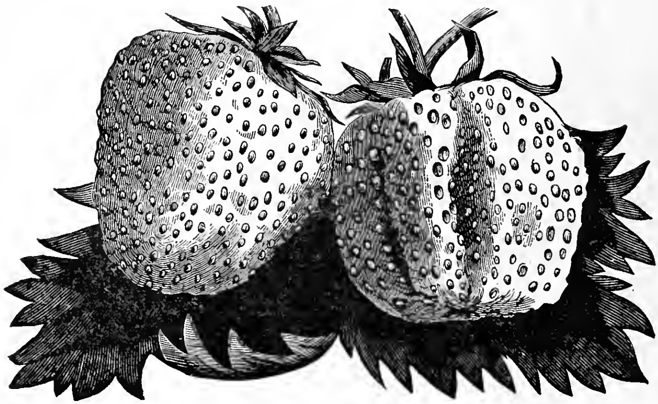
**Prince of Berries.**—This variety originated by E. W. Durand of Irvington, N. J., possesses more than any other the flavor and aroma of the wild berry. It is brilliant scarlet in color, of large size, fine texture, ripens evenly and perfectly, and for market or family purposes has no superior. It presents its calyx in such a manner as to be easily separated from it without disfiguring the berry, while the plant is a hardy and luxuriant grower.

**Jersey Queen.**—This is one of Mr. E. W. Durand's most promising seedlings. Plant, a very strong, robust grower; fruit large, of fine texture, delicious flavor, and beautiful bright scarlet. A very superior variety.

**The Sharpless Seedling.**—This strawberry originated in Pennsylvania in 1872, by Mr. J. K. Sharpless, and is now well known in many sections of the country, where it meets with popular favor. It is large, sweet, and luscious, with a delicate aroma and firm flesh; color clear, bright red, with a shining surface. In form, it is usually oblong, narrowing at the apex, and somewhat irregular and flattened. A berry of this variety exhibited not long since at the Nurserymen's convention in Rochester weighed $1\frac{1}{16}$ ounces, and measured seven inches in circumference. Our illustration was obtained from a sketch of fruit grown by Messrs. Ellwanger & Barry, Rochester, N. Y., and is a very correct representation of this variety. The plant is hardy, vigorous, and prolific.

**The "Captain Jack"** is a large, fine-flavored berry, very productive and handsome. It somewhat resembles the Wilson, of which it is said to be a seedling, although it is much superior in size and quality. The plant grows luxuriantly, and is very hardy.

**Monarch of the West.**—This is also a large variety, which has been quite popular and extensively cultivated in the west. It requires a rich soil and better cultivation than many of the other standard varieties, in order to obtain the best results. Its chief fault is in sometimes having green ends to the fruit, which renders it not quite as available for market purposes, although for family use this may not be as objectionable. The illustration of this beautiful variety, together with those that follow, are made from photographs of the natural



MONARCH OF THE WEST.

size of the fruit, and were obtained from the well-known nurseryman, Mr. Wm. Parry, of Cinnaminson, New Jersey.

**The Longfellow** is very productive, ripening evenly, with no green ends, and is above the average size, the berry being long in form. Mr. Parry says of it:—

"It has furnished good picking every day for twenty days, the fruit being large and fine at the last picking; color dark red; flavor first quality, sweet and rich. Flesh very firm; ships well; grown in same beds with fifteen of the newer varieties, it combines more good qualities than any other one."

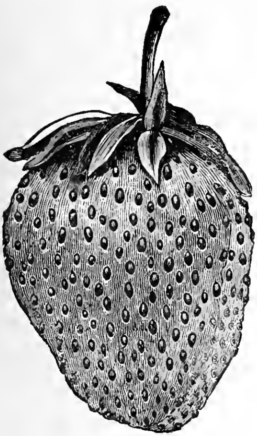
**The Essex Beauty** is remarkably regular in form, which is conical, with a well-defined neck; it is of fine texture and flavor, and ships better than many varieties; color a rich crimson. It is quite prolific and bears its fruit well up from the ground, ripening evenly.

**The Warren** is perfectly beautiful in size, form, and color, and for this reason is said to be, for a fancy market berry, one that is unsurpassed in its salable qualities, as well as in bringing the best price. It is of good, average size and delicate flavor; the color dark

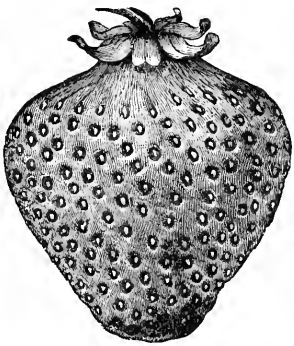
red. Besides being very productive, the plants are vigorous, hardy, and easily cultivated. Other fine varieties are the WINDSOR CHIEF, a productive variety resembling the CHAMPION; the KENTUCKY, a valuable kind, producing fruit after many varieties have ceased bearing MINER'S GREAT PROLIFIC, BOYDEN, JUCUNDA, GOV. JEWELL (seedling), a new variety of great promise, etc.

**Hermaphrodite and Pistillate Plants.**—Strawberries are divided into classes, characterized by their blossoms. The first is called *staminate* (or male) because the stamens are chiefly developed; the second *hermaphrodite* (or perfect), on account of their having both stamens and pistils developed; the third *pistillate* (or female), from the pistils being principally developed. A plant producing only male flowers cannot bear fruit, and is rarely found among cultivated varieties.

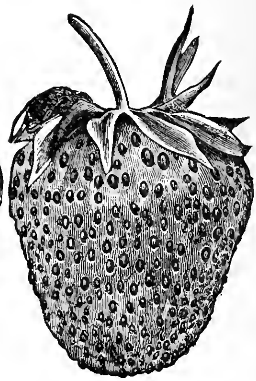
The hermaphrodites may be easily distinguished from the pistillate varieties at the time of blossoming, by the long yellow anthers that protrude from among the pistils, these being very abundant and bearing a fine dust or pollen. In the pistillate or imperfect blossomed varieties, only the cluster of pistils is visible in the blossoms, the pistils being closely packed together, and resembling a very minute green strawberry. The hermaphrodite varieties, having perfect blossoms, produce full crops without being fertilized by the pollen from other



LONGFELLOW.



ESSEX BEAUTY.



WARREN.

varieties; but the pistillate varieties (some which are very productive), in order to bear well, require a bed, or one or two rows of hermaphrodites to be planted within from fifteen to thirty feet of them, so that the pollen from the blossoms of the latter will fertilize those of the former. Varieties blossoming about the same time should be selected to fertilize each other. The hermaphrodite varieties are generally preferred by planters, since they require no care of this kind. As many of our best varieties belong to the *pistillate* class, however, as of the *hermaphrodite*.

**Propagation and Soil.**—The strawberry plant is easily and rapidly propagated by means of the runners, which are used for forming a new plantation or bed. New varieties may be produced by planting the seed, or by hybridizing the same as with all other plants. A deep, rich, moist loam is the best soil for strawberries, although they will grow on almost any soil that is not too wet. Vast quantities of this fruit are produced on light sandy soils, although on the former they attain their greatest perfection. When lands intended for cultivating this fruit are too wet, they should first be well underdrained. Where the soil is light or thin, the ground should be deeply trenched and manured before putting in the plants. In

preparing the land for this crop, the ground should be plowed or spaded deep, at least from six to eight inches, and sometimes two or three times their depth, according to the nature of the soil.

Care must be used not to throw up the subsoil to the surface, as it will be apt, as a general rule, to deteriorate the quality of the surface soil. It should, however be broken up if of a hard, clayey nature. The land should be thoroughly prepared and made quite rich. An extensive strawberry grower in Connecticut says:

"The main point to start with, is to have a reasonably good soil, one that will at least produce thirty to forty bushels of shelled corn per acre, well drained, either naturally or artificially, and has been cultivated in hoed crops for at least two years. Would not advise planting directly after potatoes, as they exhaust the potash from the soil, which is of great value to the strawberry plant. Plow deep, and, if possible, use a sub-soil plow. From my own experience I believe it will add at least twenty-five per cent. to the value of the crop in helping to retain the moisture in a dry season, and for a more perfect drainage in a wet one. After plowing, harrow thoroughly with a La Dow, Randall, or Acme harrow, any one of which is worth twice its cost in preparing a strawberry field. By thoroughly, we do not mean once or twice over, but six or eight times, until you think you have done it to perfection, and then harrow it over again."

**Manures and Fertilizers.** — Various kinds of manures are used with benefit on land devoted to the culture of strawberries, but for many soils perhaps there is nothing better than well-rotted barnyard manure. On lands that are very rich, it is better to use some of the concentrated fertilizers, as barnyard manure will be liable to cause the plants to make too heavy foliage. Bone dust, scattered broadcast and worked into the soil before planting, or when cultivating is excellent for this purpose. Well-fermented compost, of about four hundred pounds each of ground bone, wood ashes, muck. and marl, applied to an acre, makes an excellent fertilizer. Leaf mould, soil from the woods, decomposed turf, guano, hen manure, superphosphate, and most of the concentrated fertilizers are good, either used alone or applied together, or when mixed with other things in a compost. Hen manure and guano should be used sparingly, and be well mingled with the soil; if the roots come directly in contact with it, they will be injured.

**Time for Setting the Plants.** — Strawberry plants may be set either in the fall or spring. When set in the fall rather early, so that the roots may become well established in the soil before the ground freezes, there will be less liability of the plants winter-killing than when set late in autumn ; and when well cared for will frequently produce a small crop of fruit the next summer. Those set out in the spring will not produce many berries the first season, and should not be allowed to bear, but to develop into vigorous plants, which will be less liable to winter-kill than those set in the fall, and with good care will produce abundantly the following year.

**Planting Strawberries.** — The following directions for planting and cultivating strawberries, from the pen of the well-known nurseryman, Mr. R. H. Haines, of Moorestown, N. J., will be found full of valuable suggestions to growers of this fruit: The quickest method, and an excellent way when planting largely, is to open furrows with a plow at the proper distances, and then, holding the plant with the left hand against the straight side of the furrow, fill in some soil against the roots with the other hand, or with a hoe or trowel. An assistant might then press the soil firmly with his foot against the roots, if not too wet, and afterwards fill up the furrow level, or nearly level, with the surface, again "firming it" lightly.

A somewhat similar method for the garden is to open holes with a spade at the required distances, with the back of the spade against a garden line, and planting as before, spreading

the roots like a fan if possible. If planting in a hot sun, or when exposed to drying winds, the plants should be kept in pails, boxes, or lined baskets, and roots kept moist. The roots are sometimes dried more in ten minutes in the open air than in going 2,000 miles through the mails Some persons prefer to dip the roots in a puddle made of clayish soil or muck when received, also when planting.

Another method for planting is to push the spade (or trowel) down into the soil, and then, by pushing it forward, insert the roots behind the spade without withdrawing it. This is an excellent way when planting in summer, or in very dry weather. If the soil is very dry, a pint or two of water may be poured into the cavity. River or rain water, or water that has been drawn and exposed to the air for some hours, is better than *cold* spring water. Next run the spade or trowel down into the soil, about an inch further out, and pry the soil back into place against the roots, and level off the ground.

A fourth method is to dig a hole with a trowel, and, after making a little mound in the bottom of the hole, spread the roots around upon it. Next fill in part of the soil, and if very dry pour in some water. A little well-rotted manure (not strong fertilizers), if placed in the hole before filling up, will often give the plants a good start. Before finishing, if not too wet, press the soil firmly with a trowel, or moderately firm with the foot, and leave the last half inch of soil loose, so as better to catch the rain or dew, and to prevent the soil from baking. The mound in the bottom may be omitted if time is limited.

**Distances for Planting.**—The "hill" system is the favorite method in garden culture, except where the soil is very light and sandy, or overrun with grubs. It merely consists in keeping all runners cut off, thus keeping each plant separately by itself. In garden culture, where the space is limited, the rows may be made either a foot and a half or two feet apart, with plants either eight, twelve, fifteen, or eighteen inches apart in the rows. A space two or three feet wide may be left between every three, or four, or five rows, to be used as a walk, or as a dividing line, or as a surface drain. If for the last purpose, it will want to be lower than the rest of the bed. The nearer the rows are to each other, the less mulching will be required. These different distances will give opportunities for experimenting, and all of them might be tried to see which will give the best satisfaction on the soils of each cultivator. Usually the largest berries are obtained from plants grown by the "hill" system, with the rows two or three feet apart, and plants fifteen inches apart, though more berries are often obtained by planting nearer together.

In field culture, the "hill" system is usually followed if the soil is heavy or of a clayey nature. The rows are then made either two and a half or three feet apart, usually three feet, when about 14,500 plants are required to the acre. If the garden plot is large, and can be arranged so as to permit of horse-power, then I would also recommend this same distance of three feet between the rows. Berries usually are sweeter and ripen more evenly when grown by the "hill" system, as they are more exposed to the sun and air than when grown in "matted" rows.

The "matted" row system consists in having the rows either three, four, or five feet apart, and allowing the runners to take root on both sides of the parent plants. It is followed almost entirely in field culture where the soil is sandy, and frequently upon gravelly soils and upon easily worked loams. The plants may be set out at twelve or eighteen inches apart, and the rows, being more widely separated, require less plants to the acre than by the "hill" system. A "partially matted row" system is to allow only four or six runners to take root from each plant, cutting off the rest. Excellent crops of fine berries can usually be obtained in this way.

Another method, called the "matted hill system," is to mark off the land both ways, as if for corn, placing one or two plants at every crossing, which may be either three or four feet from each other. Run the cultivator lengthways, and also across the row, during the

season, fastening in the first runners by hand if necessary, and narrowing the cultivator as the "matted hills" become larger. This method requires little hoeing, and gives excellent crops. In gardens, smaller "matted hills" may be made by planting three or four plants together every two or two and a half feet, or planting one plant and allowing it to make three or four runners.

Another plan for garden or field culture is to place a plant every two feet, with rows two feet apart, and to cultivate both ways, keeping all runners cut off. It is sometimes surprising to see what a vigorous growth, and what immense crops of large berries a single plant will give, when allowed plenty of room and well cultivated. All of the above plans will give good results, and they each have their supporters among different fruit growers or amateurs.

At the South, in garden culture, I am inclined to believe that where the "hill system" can be practiced, excellent results will follow having the rows fifteen, eighteen, or twenty-four inches apart, as the foliage of the plants will then nearly cover and shade the ground, and less mulching will be required between the rows. The "hill system" is probably preferable in gardens at the North, even on light, sandy soils, provided the plants are kept well mulched. It will be seen that there is here an ample field for experimenting, with its accompanying change of thought and recreation, for business or professional men. During the first year, crops of lettuce, dwarf peas, bush beans, spinach, etc., may be raised between the rows in gardens where the "hill system" is followed, and where space is limited.

**To Prevent the Mixing of Strawberry Plants.**— Varieties only become mixed from the runners intermingling so that the plants cannot be distinguished, or from young plants springing up from seeds. This last, however, seldom happens, and when it does the young plants are usually the same. The intermingling of runners may be prevented by having the different kinds in rows five or six feet apart, and by keeping the cultivator running occasionally during the summer. Another way is to have the different kinds eight or ten feet apart. In the "hill system," where the runners are kept cut, there is of course no danger of their intermingling, even if the rows are only two or three feet apart. When two or more kinds are planted in the same matted row, then the runners may be kept cut from the plants that join, or may be turned away from each other, or a vacancy of a few feet may be left in the row between the different kinds. When understood, it is a matter that can be easily arranged.

**Cutting Off Blossoms.**— Most fruit growers, and especially those who grow fruit for market, make a practice of cutting off all the blossoms from newly-set plants, as, when left on, it prevents their making as strong a growth for the main crop of the second year. If any are permitted to remain, it is only upon a few of the strongest plants, and then usually only a single stem or blossom is saved as a sample, though usually the largest specimen berries cannot be obtained except from plants that have been set out at least six or eight months. In gardens where the fruit is wanted, the blossoms may be left on all except the smallest plants; but if planted late in April, or in May or June, the grower will do much better to cut off all except an occasional fruit stem.

**Cultivation.**— Strawberries should be hoed or cultivated *at least* three times the first year: once in May, once in July, and again in August. If it can be done every two or three weeks, from early in April until October, then a much stronger growth can be obtained. In the end, it is about as easy to cultivate or hoe the ground *frequently* as to do it only a few times in the season, as more weeds can usually be killed in an hour, when they are only quarter of an inch high, than in three hours when six inches high and wedged in among the plants. When the hoe or pronged hoe is used, the soil should at times be loosened or stirred

to a depth of from four to six inches, except close in among the roots, when an inch or two in depth is sufficient. The use of a small plow is also of great advantage in keeping the soil well stirred. Even in the "hill system" the ground should be kept level, not hilled up around the plants.

When using the "matted row" system, the cultivator should always be run in the same direction, after the runners appear, one or two paths north, and the next one or two towards the south, etc., and should be narrowed each succeeding time as the plants spread, until only a path a foot wide is left. A solid bed of plants, three or four feet wide, will thus be formed quicker and easier than if the young plants are disturbed by pulling round the runners in opposite directions. When following the "matted hill" system, it is also well to drive always in the same direction for the same paths after the runners appear, and to narrow the cultivator as the "matted hill" becomes larger.

**Watering in a Drouth.**—One good watering, once or twice a week, in the morning or evening, is better than ten times as often if improperly done. The proper way to do is to draw away a little of the soil from one side, or from around the plant, and allow a pint or more of water to soak in around the roots. Afterwards replace the dry soil that was removed, and there will be no complaints about the ground baking, while the soil underneath will keep moist for some days longer, on account of the mulching of dry loose earth on top. A slight watering on the surface often seems to have the effect of burning up or dwarfing the plants. Old fruit or tomato cans, with a small hole in the bottom, and sunk a little ways into the soil at one side of the plant, and filled occasionally with water, are excellent for giving a steady supply of moisture.

**Mulching Strawberries.**—This should be done a month or two before the time of fruiting, in order to keep the green and ripe berries from being spattered with sand or mud during rain storms. It also assists in retaining moisture in the soil, and, consequently, in obtaining much larger berries. Any refuse material will answer, such as cut grass, marsh hay, straw, cornstalks, sorghum, coarse manure, pine needles, leaf mould, leaves, etc. To be of any special benefit the mulching should be applied at least two inches thick and one foot wide on each side of the plants, while it is better, if possible, to have it twice as thick and wider. Tan-bark or saw-dust (if rotted) can be used, but should be gathered up after the fruiting season, unless on clayey soils. Boards with or without other mulching, are excellent for keeping the soils moist, and also from getting hardened during the picking season. At the extreme south the mulching should be placed around the plants earlier in the season, and kept on during the summer, changing it from one path to another, if any cultivation is performed. If a few young plants are wanted, then the runners may be allowed to take root in an occasional vacant path.

**Growing Large Berries.**—Much, of course, depends upon the variety; but, having selected the right kinds, it is not difficult to improve greatly over the ordinary ways followed. Apply well-rotted barnyard manure from one to three inches thick, and have the ground spaded or plowed deeply—even twelve or eighteen inches if the soil is good, and in a way to mix thoroughly the manure with the soil. A quart or two of bone-dust or other fertilizer to each square rod may afterwards be spread broadcast, and mixed six inches down, but it is not necessary. Cultivate or hoe frequently during the spring and summer, keeping the runners closely cut. Give winter protection, and hoe or dig the ground three or four inches deep previous to time of blossoming in spring. In May, mulch the plants well, and a rich reward will duly appear. Extra-sized berries can also be often obtained by removing one-fourth or one-half of the fruit stems to each plant, and clipping out a number of the inferior berries on each stalk. Old fruit cans, arranged to let the water out slowly, will help to swell the fruit to large proportions, if placed near the plants, and frequently filled with water. Half a

teaspoonful of ammonia (hartshorn) may be added with benefit to each quart of water when watering. If, in November, the ground *between* the plants is covered thickly with rotted manure, before giving winter protection, it will greatly add to the quantity and size of the berries. Thinning out the fruit stalks or berries is seldom practiced.

**Winter Protection.**—In the fall, just before the ground commences to freeze, or within two or three weeks afterwards, strawberry plants should be mulched or covered with some coarse material, to prevent them from alternate freezing and thawing during the winter or spring. Rye or wheat straw, or coarse manure, is most generally applied for this purpose. spreading about one inch thick. In the latitude of New Jersey a cheap and excellent covering for narrow rows is from one to three inches of soil. Evergreen boughs, pine needles, salt or marsh hay, or other coarse material that will not pack closely and smother the plants, are all good. A mulching of corn-stalks, placed crosswise, will answer. If the ground is first covered with rotted manure, great benefit will usually be obtained. It may be lightly dug under in spring. Leaves sometimes smother the plants. Many persons use them, however, adding an inch of soil to keep them in place. Scattered thinly over matted rows, and with a *very little* soil scattered here and there over them, is a better way to employ them. If the mulching material of straw, etc., is applied at the commencement of a rain or snow storm, it will seldom need any poles to keep it from blowing off. Another method of mulching is to sow oats thickly over the beds about September 1, and allow the straw to fall down and cover the plants. Most growers allow the mulch of coarse manure, straw, salt hay, or pine needles to be left on until after fruiting, merely removing the mulch from over the crown of the plants in the spring, if too thick. Coarse manure becomes bleached by that time, and is sufficiently clean. In removing the mulch, wait until about the time that the ground ceases to freeze and thaw.

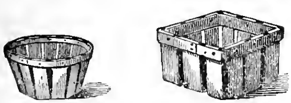
**Cultivation the Second Year.**—When the time can be given, we prefer to have the mulching removed, early in April, from all except the matted rows. If plants are covered with leaves, soil, corn-stalks, or evergreen boughs, it must, of course, be done. After hoeing or spading the ground from two to three inches deep. it may be again placed around the plants and in the paths. The soil should not be disturbed while very wet, nor after the plants are in blossom. The paths between the matted rows may also be spaded at this time, and be mulched again some weeks before fruiting. Though we consider it to be an advantage to give shallow cultivation early in the spring, yet, if entirely dispensed with, good crops may still be obtained.

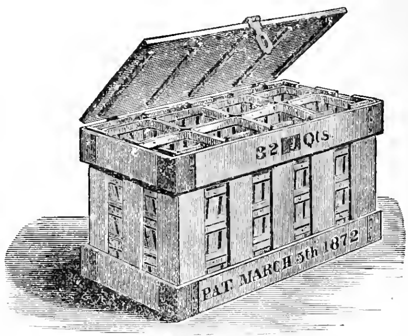
**Treatment of Plants after Fruiting.**—Plants grown in "matted rows" are usually allowed to bear only one crop, and are then plowed under, and the grouud at once planted with tomatoes or winter cabbages, or sown with turnip seed, sweet corn, buckwheat, or other grain. When this is the custom, a new plot of strawberries is made each spring. Sometimes, when the weeds are not very bad, the beds may be cleaned up, and the paths spaded or plowed, and occasionally cultivated during the season. A top-dressing of fine manure, bonedust, or other fertilizer, should be given in such cases. Another way is to mow down all except a narrow strip in each matted row, rake off the foliage, and plow or spade up all except the strips that have been left—first manuring the ground if possible. New runners will soon appear, and, by using the cultivator, as in the preceding year, new "matted rows" will be formed.

Old beds grown by the "hill system" are more easily managed. Apply manure or fertilizers, plow or spade up the soil, hoe out the weeds, and loosen the soil in among the plants. Cultivate afterwards the same as the first year. I do not recommend cutting off the foliage. except in wet seasons; however, if the plants, or the south half of each plant, are left, a partial shade will yet remain. An inch or two of fresh soil from the paths or elsewhere, is

a decided benefit if placed around the plants. By filling up the plants each fall with an inch or two of manure, and by cleaning out the beds immediately after fruiting, plants grown "in hills" and given good cultivation, will often give fine crops for from three to six years. "Matted hills" may be renewed by spading or plowing up all except one corner or the center of each hill. Beds growing broadcast can be made to produce good crops, by spading up all except narrow strips of the youngest plants, and by working in plenty of fine manure, or hen manure, etc., among the plants. As plants "run out," or usually lose their vigor after being planted in the same place for three or four years, it is best to obtain a fresh supply from outside or distant parties every few years.

**To Hasten the Time of Ripening.**—Early berries generally bring the best prices. If early varieties are planted on the south side of a thick hedge, or of a close fence or wall, it is possible to get fruit some days earlier than otherwise. The southern slopes of a hill, or of an artificial ridge made two or three feet high, are also favorable. If planted on northern slopes, or in thickly matted rows, or on clay soils, their time of ripening can be retarded. On light or sandy soils, if not too rich, they will ripen early, whether "in hills" or "matted rows." A few quarts of early berries may be obtained by placing a hot bed frame and glass over some early variety in the garden. This should be done very early in spring, or at the close of winter, if tried. Keep well covered with old carpets, straw, or matting when the nights are cold. Give air on warm days. Even without the glass, by covering the frame at night, early berries may be obtained. Strawberries at the North usually do best where fully exposed to the sun, but good crops can also be obtained in orchards where the shade is not too thick. Good drainage, either natural or artificial, is especially important at the South, to prevent the soil from baking too hard, and the plants from burning up.


FRUIT BASKETS.



FRUIT CRATE.

**Ripening or Coloring Berries.**—Occasionally it is desired to color berries that, from some cause, have only partially colored. The simplest plan is to support the fruit stalks four inches above ground by means of a stout wire. The ends of the wire may be driven into the ground, while the rest of the wire may be bent to fit half around the plant and to support the fruit. Barrel hoops or other materials may also be used to raise the berries from the ground, and thus to give them sunlight.

**Picking and Marketing.**—Strawberries will keep in much better condition, and sell at higher figures if carefully picked with half an inch of the stem attached. The stem and hulls allow the air to circulate more freely among the berries. In packing for market the berries are usually put in quart baskets that are packed in thirty-two quart well-ventilated

crates. Pint baskets are sometimes used for marketing berries, but less commonly than those holding a quart.

**Yield and Profits.**—From two hundred to four hundred bushels of strawberries are sometimes obtained from an acre, although a more common yield is from fifty to one hundred bushels per acre. The total cost of plants, cultivation, picking, etc., is usually from $75 to $100 per acre. The writer knows of a case in which $110 worth of Jucunda berries were sold from one-eighth of an acre, and another in which a crop of Boydens was sold at the rate of over $1,500 per acre. Two ladies in Centralia, Ill., are said to have raised and sold nearly $850 worth of berries from an acre and a quarter of land. A gentleman in New Jersey not long since raised one hundred and fifty bushels of berries from half an acre of land and sold them for $500.

Mr. William H. Earle of Mass., says: "If one takes interest in the business of strawberry culture he will be surprised at the possible results. On about three acres of land I realized a gross income of a little over two thousand dollars."

The owner of a plantation of twenty-five acres devoted to strawberry culture, near Norfolk, Virginia, says: "My twenty-five acres would produce 3,000 crates. Half of these," said he, "are lost by bad picking, neglect, or stealing. We will only count on 1,500 crates sure, as coming from that amount of land. Each crate holds sixty quarts, which we sell at ten cents a quart to retailers and commission agents in other cities. We get back in money from the produce of that many acres the sum of $9,000. This is an actual average."

The above results may not be the common average of growers of this fruit, but they show what may be accomplished with suitable care and other favoring conditions.

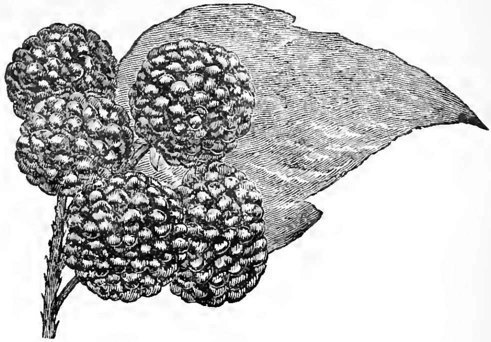
**Diseases and Insect Enemies.**—The rust or leaf blight sometimes attacks the strawberry plant. The grubs are also occasionally very destructive by feeding upon the roots, causing the plants to wither and die. Common salt sown broadcast at the rate of three or four bushels to the acre, or well mixed with the soil a week or two before planting will sometimes eradicate them. The same quantity applied about the roots in liquid form might hasten the effect in time of drouth. Another method is to dip the roots of the plant in Paris Green at the time of planting. Soot, wood ashes, muriate of potash, or land plaster are also highly recommended, but the ashes and potash should be sowed with caution in a sandy soil. The strawberry worm is also very troublesome in some sections of the country, feeding upon the leaves, which causes them to shrivel or curl and to dry up. Paris Green applied the same as for the Colorado beetle in potato culture, once a week for three or four weeks before the berries are set, will eradicate it. The solution should be made of one or two teaspoonfuls of the powder to two or three gallons of water. It should never be used when berries are in the vines, as it is a deadly poison.

**Raspberries.**—The raspberry is found growing wild in a large portion of both the Eastern and Western Continents, but when cultivated, the fruit is much larger than that of the wild growth, and the plants are also much more productive. New kinds have also been obtained by hybridization and from the seed, which, together with the advantages obtained from careful cultivation, have resulted in producing very fine varieties of this delicious and popular fruit. The European and Asiatic varieties (*Rubus idæus*) are of an upright habit of growth, with bristles on the canes, which are mostly straight, and produce plants from sprouts coming from the roots. They may also be propagated by planting root-cuttings. The American Red varieties (*Rubus strigosus*) are thought by many to be a variety of the same species, being of similar habits of growth, and also propagated from suckers. The black varieties belong to the *Rubus occidentalis* species. A few of the yellow and red varieties that are propagated by the tips of the canes taking root in the soil are also closely allied to this class.

The *Rubus strigosus* species frequently send up suckers so abundantly as to become troublesome, filling the ground with young canes, which crowd the bearing plants and injure the

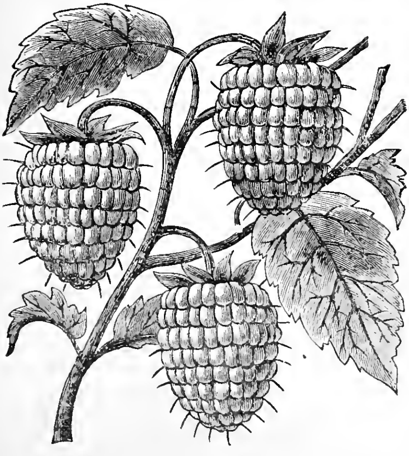
SOUHEGAN RASPBERRY,

crop of fruit. When scarce, varieties of this species may be rapidly increased by cutting the roots in pieces of one or two inches in length, and planting in an ordinary hot-bed, or under glass, until the canes are a few inches in height, when they may be transplanted in rows to form a new plantation. As the *Rubus occidentalis* forms new plants by the tips of its canes taking root in the ground, during the latter part of summer, when the soil is usually dry and hard, the tender tops cannot readily take hold without assistance, while the wind moving them back and forward in the hard ground will soon be liable to destroy their vitality. It will therefore be necessary for the cultivator of such varieties to go over the ground frequently during the season, and with a trowel cover the tips of the best canes with soil, where they will soon take root and form new plants, which can be taken up and transplanted in the fall or following spring. The varieties of this species are generally very hardy, and able to withstand the extremes of heat and cold better than most others. The raspberry is very easily cultivated, hence there is no reason why the family of every farmer should not have an abundance of this delicious and healthful fruit in its season, while raspberry jam, syrups, preserves, tarts, ices, and jellies are relished at other seasons of the year in every household, and add much to the variety and luxury of the table.



GREGG RASPBERRY.

**Varieties.**—There are numerous varieties of raspberries, and new ones are constantly being introduced. There are some that are more hardy than others, some being alike sensitive to the cold of the severe winters at the North and the burning sun at the South, while others thrive well in either extreme of climate. Among some of the best red varieties are the Cuthbert, Reliance, Brandywine, Turner, Shaffer, Superb, Herstine, and Queen of the Market. Among the standard black caps we have the Gregg, Mammoth Cluster, Davidson's Thornless, Doolittle, Souhegan, etc. Brinkle's Orange, Canada Yellow, Caroline, and the Florence are fine yellow varieties.



THE CUTHBERT.

**Cuthbert.**—This has proved one of the best and most reliable red raspberries in cultivation, having given excellent satisfaction throughout the country, even in the far North. The plant is quite prolific, vigorous, and hardy, fruit large, deep red, and fine flavored. It is said that berries of this variety have been grown measuring three inches in circumference. Being quite firm, it stands

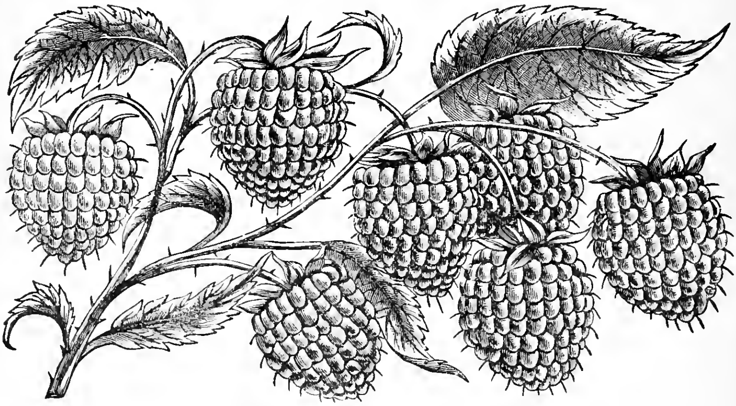
transportation well, being fully equal in this respect to the Brandywine. Season medium, till quite late. The cut of this variety, and that of the Herstine, Queen of the Market, and Gregg, were made from photographs of fruit grown by Mr. Wm. Parry, of Cinnaminson, N. J.

**Reliance.**—This is a seedling raised from the Philadelphia; the plants are very productive, hardy, and make but few suckers. It is an excellent variety, either for home use or the market. The fruit is of dark red or crimson, large, and of good quality.

**Brandywine.**—An old and reliable market variety. The plants are very productive, and endure well the extremes of heat and cold, requiring winter protection only in the very coldest localities, while it endures the drouth of the South better than most varieties. It ripens moderately early, and is one of the best to endure shipment for long distances. Berries of good quality, firm flesh, and bright red color.

**Shaffer.**—The plants and fruit of this variety both attain a large and vigorous growth; color a dull, brownish red; sprightly sub-acid flavor that renders it of especial value for canning purposes.

**Superb.**—A seedling of the old and once popular variety, the Philadelphia. This is a very prolific berry, a strong and vigorous grower, fruit large, rich crimson in color, spicy flavor, and one of the earliest to ripen.



QUEEN OF THE MARKET RASPBERRY.

**The Gregg** is one of the very best of the black varieties. It originated in Indiana. The plant is a strong grower, prolific and hardy. The berries are large, color deep black, with a decided flavor. It is one of the most popular varieties for home use or late market.

**Herstine.**—A large, half hardy, red raspberry; a good grower; abundant and early bearer; suckers moderate; canes strong, covered with a white bloom; foliage healthy, of medium size; fruit oblong, with small grains, and bright crimson color; flavor sub-acid and very good. It thrives well in sections where the winters are not very severe.

**Queen of the Market.** — A variety similar in many respects to the Cuthbert, being vigorous, hardy, and productive, with more than the average amount of firmness of flesh, while it is of very fair quality.

**Souhegan.**—This variety originated in Hillsboro Co., N. H., and is exceedingly productive, the berries growing in clusters, as will be seen by the cut of it, which represents a branch of that fruit grown by Messrs. G. H. and J. H. Hale of South Glastonbury, Conn. The canes are quite vigorous, branching freely, and have many strong, sharp spires, while it

is one of the hardiest varieties known. The fruit is of good quality, large size, jet black in color, and ripens among the earliest, which is at the time when strawberries are getting scarce in the market.

**Brinkle's Orange.**—A variety of excellent quality; fruit large, fine flavored, and light yellow in color. The plant is a good grower, but not hardy, and must have winter protection at the North.

**Carolinas.**—This is a seedling of Brinkle's Orange, to which it bears a close resemblance in appearance and quality. The plant is, however, quite hardy.

**Soil.**—Raspberries may be grown on almost any soil that will produce a good crop of corn or potatoes. Care should be used, however, to avoid very heavy clay soils, and such as are liable to remain water-soaked during the winter. The black varieties are more hardy than the red, and good crops—but not the best—may be grown on even hard clay or wet soils. A rich, gravelly soil, or a moist loam of good quality, are perhaps the best for this fruit, while fine crops may also be produced from a deep sandy loam. The berries will ripen several days earlier on the latter soil than upon any other. It is always best, when practicable, to select such soils as are adapted to the plants, as the most satisfactory results are thus obtained.

**Manures and Fertilizers.**—Well fermented stable manure is perhaps the best for general use in raspberry culture, although there are many other fertilizers that will answer the purpose well. Decomposed sod and muck are both excellent, and especially if left exposed to the action of the frost in a barnyard during the winter. Bone dust, guano, or hen manure may be applied at the rate of from five hundred to eight hundred pounds per acre, with benefit, either broadcast and harrowed in, or placed on the surface before hoeing or cultivating. Wood ashes, leaf mould, or soil from the woods, and salt, are also good; the latter should be applied in quantity from one and a half to three bushels per acre. On very rich soil, such as the prairies of the West, ground bone and wood ashes will prove very beneficial.

**Planting.**—Land that has previously been occupied by hoed crops, or grain, is more desirable for planting raspberries, it being more easily worked, although they may be grown quite successfully on sod land after the sod has been turned under. Keep the roots moist while setting, taking pains not to allow the hot sun to dry and wither them. For *field culture* the rows may be from six to eight feet apart, with plants two or three feet apart in the rows. In *garden culture*, they may be planted at the same distance, or in hills about four feet apart each way, and one or two plants in a hill. Some place the thrifty growing cap varieties at five feet apart In planting for field culture the usual custom is to turn a furrow with a plow for setting. Place the plants in at about the same depth of soil they previously occupied, and cover the roots with a hoe or small plow. When a spade is used for planting, make the excavation for the roots sufficiently large to allow them to spread out well. Unless the ground is quite wet, press the soil a little with the foot in setting, just before filling in the last inch or two of depth.

This will aid the roots in retaining the moisture of the soil, and also the plants in maintaining a secure upright position. If it is very warm at the time of planting, and the canes are in leaf, the plants may require shading for a few days; otherwise they will not. Many fruit growers consider it beneficial to cut off the canes within from two to six inches of the ground after setting, in order to give them a more vigorous start when planting in the spring. This is not desirable when planting in the fall. The usual time for planting raspberries and blackberries is during the month of October or early November; this gives the roots a chance to grow before the ground freezes, which they will do even when the tops are dormant. Red raspberries will remain in prime bearing condition from six to eight years, with good care, until they will frequently contrive to yield fair crops from fifteen to twenty years.

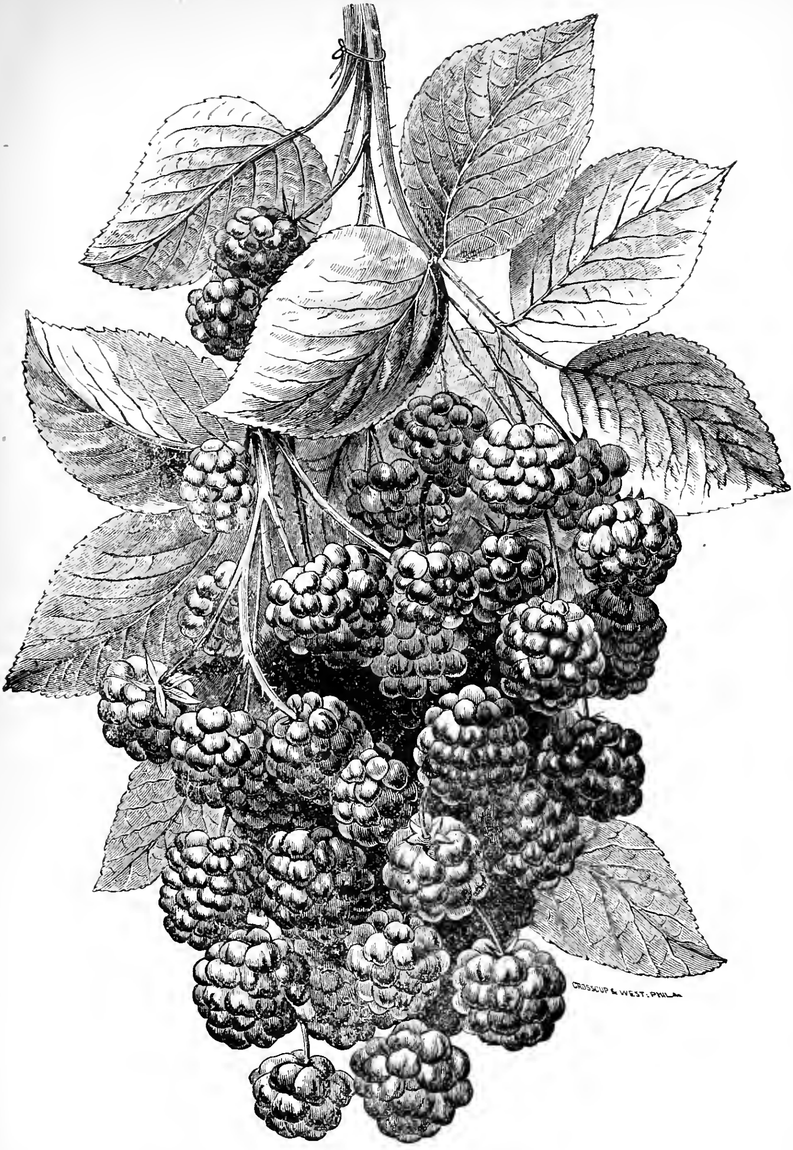
**Planting at the South.**—In planting raspberries at the extreme South, light sandy loams should be avoided, unless there is a clayey sub-soil within two or three feet of the surface, to aid in retaining moisture. If the soil be light and sandy, and the sub-soil of a leachey nature, the plants would be liable to dry up for lack of moisture. Almost all of the black caps, and many of the red and yellow varieties of the same family thrive well at the South; a few, however, such as the Highland Hardy, Pride of the Hudson, etc., require a colder climate.

**Cultivation.**—The soil should be kept loose, friable, and free from weeds by the use of a cultivator or occasional shallow plowing, during the spring and summer, except perhaps a short time before and during the fruiting season. This is especially necessary in the cultivation of young growing plants. When grown in hills, allow but from three to five of the best canes to remain in each hill, hoeing or cutting out all others. If grown in rows, keep the rows narrow by hoeing out part of the young suckers.

**Mulching.**—A mulching in the spring, or before or during the fruiting season is very beneficial in some portions of the country, especially at the South, or at the North, wherever the planting is on a dry soil, or in a dry season, as this prevents the plants from drying up, and thus secures a larger crop of better berries. Any coarse material will answer the purpose, such as straw, coarse hay, sorghum, corn-stalks, coarse manure, pine needles, leaf mold, etc. The mulching should be applied from two to four inches thick, and two feet wide on each side of the plants. Plants that are well mulched will have a good amount of root moisture, and will also require but little cultivation, as the mulching smothers the weeds, and keeps the soil friable. When practiced at the South, the mulching should be applied in April or May, and kept on during the summer, leaving three or four inches of space around the plants in spring for the growth of the new canes. Mulching is very essential during the first season of planting at the South; otherwise plants are very liable to dry up and die for lack of moisture, being more tender when first starting in the soil.

**Staking.**—The following methods of staking and pruning raspberries are recommended by Mr. R. H. Haines of New Jersey, who is an excellent authority on all matters pertaining to the culture of fruits: Though stakes are not required if the "pinching-in" process is followed, yet, in garden culture, they are sometimes used by those who wish their plants to grow close together. One way, that is usually followed, is to drive a stake down in each hill, and tie the canes to it. Another method is to drive down two stakes, one on each side of a hill. and nail a barrel hoop to them, thus enclosing the canes. Another method is to drive down a stake every ten or twenty feet, and stretch one or two wires on them at a distance of from three to four feet from the ground. A fourth plan is to nail a wooden strip to the tops of stakes, at a height of three or four feet from the ground, with another strip lower down when desired. Any of these plans can be followed with very little trouble and at slight cost; but when summer pruning is practiced, or when plants are grown in continuous rows, and cut off at from three to three and a half feet from the ground, the stakes are entirely unnecessary, and especially if the plants are well mulched, as the mulching will keep the fruit from coming into contact with the ground, and from becoming soiled.

**Summer Pruning.**—The first season only two or three raspberry shoots or canes should be allowed to grow up from each hill; any others should be hoed down the same as weeds, where fruit is the object. In June, July, and August, or as soon as the canes reach a height of from two to three feet, the tops should be pinched off or broken off with the thumb and finger. The more vigorous shoots may be allowed to grow to even three feet in height, if desired. If this summer pruning should be neglected the first year until the canes have grown quite tall, then it is probably best not to cut them back quite so far. A knife or shears will sometimes be required where there is much of a growth to be taken off.




RELIANCE RASPBERRY. 1663

[Copied from photograph of fruit grown by R. H. Haines, Moorestown, N. J.]

This pinching off of the canes causes them to send out lateral shoots, so that nearly double the crop can be obtained by it. Where these lateral shoots have made a growth of a foot from the canes, they can be pinched off, causing them to put out new laterals. This second heading back may be deferred until early in spring, when desired. When treated in this way the plants become quite strong and stocky, and are enabled to withstand ordinary winds, and to hold up their fruit without the assistance of stakes. After the first year, raspberries need not be pinched off until the canes are from three to three and a half feet high. Some of the laterals, growing nearly upright, afterwards give a height to the plants of from four to five feet.

THE HERSTINE.

**Winter Pruning.**—South of Virginia, this may be performed at almost any time during the winter, but where the cold is severe it is well to defer it until the winter has passed. All the old canes, or such as had fruit upon them, should be cut out at this pruning, as fruit is only produced on raspberry or blackberry canes of the previous year's growth. With a pair of pruning shears and thick gloves, this part can be easily done; or a short briar hook on a long handle can be used.

Some persons make a practice of cutting out the old canes in July or August, immediately after the fruiting season, but I do not consider it to be advisable, as cutting away so much foliage is liable to check the growth of the young canes; while, if left, they are also quite a help in assisting the plants to withstand winter winds. In districts where half-hardy varieties require winter protection, the old canes can be cut out, and the others pruned in

October or November, just previous to covering them. However, in gardens where it is desired to keep the plants trim and neat, or where winter winds are not feared. then the old canes may be cut out at almost any time without serious injury to the plants.

In pruning the bearing canes in spring, the laterals should be cut back to within about a foot of the main stems, or when the tips are frozen, to a point back of where they have been winter-killed. The frozen canes are usually of a different color from the rest of the wood. Frequently I have had my plants pruned as late as the middle of April, waiting three or four days after the buds have opened, and then pruning off the branches just beyond a strong bud. At this pruning any surplus canes may be cut out, if not hoed out the previous year when small.

In hill culture, from three to five canes will usually give more and better fruit than if a larger number are allowed to grow. Even when grown in rows, it is best to keep the rows quite narrow, not over a foot and a half or two feet wide near the ground; cutting off or hoeing down all canes coming up in the paths.

**Winter Protection.** — In localities where the winters are very severe, it is well to give protection to raspberry vines, to prevent them from winter-killing. Some varieties will do well without this care, but most of the best varieties will do enough better to pay for the trouble. The usual and best method is to bend the canes down upon the ground, and throw a shovelful of earth upon the tops to keep them in place; then plow a furrow each side the row to afford a covering of three or four inches of soil. In the spring the canes can be loosened up with a fork; this should not, however, be done until all danger of frost is passed. Other methods are practiced, such as binding the canes to the ground and covering them with pine boughs, or to tie them to a stake and bind straw around them; but the best is that first recommended, since it affords a secure protection with the least labor, and obviates the leaving of refuse material to furnish a harbor for mice during the winter, or the scattering of waste material about to be cleaned off in the spring. The canes may be pruned in the fall, instead of the following spring, if desired. In giving winter protection by this means they will then require less covering. In protecting plants set in the fall, many growers throw a forkful of manure over each plant, instead of soil, allowing it to remain until spring, when it is mixed with the soil by the use of a light harrow. This furnishes warmth, besides fertilizing the plants for the next season's growth.

**Cultivation after the First Season.** — As soon as the weeds commence growing in the spring, shallow plowing should be given between the rows, if the ground is suitable. If the plowing is so deep as to tear the roots, injury is done; and, as the roots extend near the surface of the ground, care should be exercised in this respect. The weeds and refuse matter should then be carefully wed out from among the plants, and either carried off the land or put in the furrows and covered with soil Cultivation should be given sufficiently often to keep the earth loose and friable, and the weeds exterminated. When the plants are in blossom, no further cultivation should be given until after the fruit is picked.

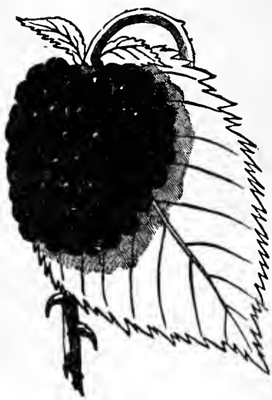
**How to Obtain a Crop of Raspberries in the Fall.** — This is done by selecting some late-bearing variety, and cutting off all the canes early in the spring, at from four to six inches from the ground, and giving good cultivation or mulching during the spring and summer. Leave only the strongest of the new shoots that come up for bearing, and these will give a fine crop of berries in the autumn, at the season when they will bring a large price in the market. A smaller crop can be obtained also in the usual season for this fruit by simply permitting the plants to grow naturally, like other raspberries, thinning out the smaller canes when too thick for a vigorous growth.

**Yield and Profits.** — With good care, raspberries may be made a very profitable crop. The average yield of the red varieties will range from fifty to sixty bushels per acre.

The black caps are somewhat more productive, and will yield from fifty to a hundred and fifty bushels to the acre, although both the red and black varieties have been known to produce much larger crops than these.

**Rust.** — This is the principal disease with which the raspberry plant is affected, and is characterized by a bright golden or orange red fungus that forms on the under sides of the leaves, causing them to curl up and wither. Sometimes it turns black after assuming the above-mentioned color. Such plants soon lose their vigor, and fail in the fruiting season. This disease, unless soon exterminated, will rapidly extend throughout the whole plantation; hence the best method is to dig up all plants thus affected, and burn them, root and branch. This should be done when the leaves are wet with dew or rain, so as to prevent the dust from being scattered upon other plants, and the disease thus spread. The application of wood ashes, salt, and lime, scattered around the plants, is said to be a good remedy, but too large a quantity of either of the last two would be liable to kill the plants.

**Blackberries.** — Like the raspberry, the blackberry grows wild in a large portion of both hemispheres, and is also becoming quite extensively cultivated for home use and market. The plants are very hardy, vigorous growers. The fruit ripens at the close of the raspberry season, and before the appearance of peaches and grapes. It holds an important position among the small fruits, bringing a high price in the market, while its rich, pleasant flavor makes it a favorite with everyone. Some of the finer varieties are very large, being from an inch to an inch and a half or more in length. Blackberry plantations that are propagated from the cuttings of healthy young shoots will, with good care, continue to yield good crops from twelve to fifteen years, or even longer.


WILSON, JR.

**Varieties.** — There are several varieties of blackberries, although the number at present cultivated does not perhaps equal those of the raspberry. Most of the valuable varieties in cultivation have been found growing wild, and were selected and saved on account of their superiority over others. From the thousands of seedlings that have been produced, but few, if any, have yet proved superior to the original plants. This may perhaps be due to the fact that less care and attention has as yet been bestowed upon this fruit, than upon some others, such as the strawberry and the grape. Although we have some very fine varieties at present in cultivation, doubtless those that are greatly superior could be produced by careful painstaking in propagating by hybridizing, and from seedlings. Some of the best varieties at present cultivated are WILSON'S EARLY, DORCHESTER, KITTATINY, SNYDER, TAYLOR'S PROLIFIC, WACHUSETT THORNLESS, and WILSON, JR. The cuts of the three varieties of blackberries which we insert represent fruit grown by Mr. Wm. Parry, of Cinnaminson, N. J. The WILSON, JR., is a seedling from the Early Wilson, to which it bears a close resemblance.

**Planting and Cultivation.** — The general cultivation of blackberries is similar to that of raspberries, with but few exceptions. They require soil that is less rich than the raspberry, and the plants, being more vigorous growers, require more room. They need but one planting, as the canes send up a spontaneous growth of suckers annually, thus renewing themselves for fruit growth the following year. If planted on soil that is too rich, there will be a luxuriant growth of vines, but a sparse growth of fruit. Mr. Wm. Parry gives the following statement with reference to his experience with this fruit: "We planted ten acres

of blackberries on thin, sandy land, which bore good crops of fruit for thirteen years, yielding several times 650, 700, and once 800 bushels of fruit, while land adjoining, equally good, planted with corn, did not produce more than half that number of bushels per acre. When the corn was removed, all was gone; to get another crop we had to manure and plant again. But not so with the blackberries, for we pick only the ripe fruit, and leave the foliage to fall upon the ground to add to its fertility. The plants being once established, the annual crop of fruit taken off may be compared to the coupons taken from government bonds, the principal remaining to produce more.

Having experimented on several kinds of soil, from a firm clay to a light blowing sand, we prefer, as the most favorable location for blackberries, a light, moist, sandy loam; well underdrained, if water would otherwise stand near the surface. Formerly we thought that low, rich land would be best, judging from the large growth of briers along the ditches and swampy places. Accordingly one of our neighbors planted ten acres of low, dark, rich land that had produced heavy crops of corn and timothy, expecting to get a corresponding one of blackberries; but in this he was disappointed, except in growth of canes, which were very large and strong, but not well ripened before winter set in, and consequently were greatly injured, and sometimes entirely killed before spring, and yielding but little or no fruit; while blackberries planted on thin, higher land, not worth near so much for agricultural purposes, produced small canes with buds well developed and wood matured before the approach of winter, and yielded heavy crops of fruit.

**WILSON'S EARLY BLACKBERRY.**

The land should be plowed and harrowed smoothly, then open furrows in the fall at a distance of eight feet apart; and if muck can be had conveniently, it is valuable to spread along the furrows during winter, leaving it exposed to the action of the frost. Early in spring set the plants nearly three feet apart, requiring 2,000 plants to one acre. The intervening space, while the plants are small, need not be lost, but corn, potatoes, or other vegetables may be grown midway between the rows for the first year or two. The roots will mostly follow along the muck, and grow more vigorously than lateral or side shoots. Hence the strongest and best plants will come up nearly where they are wanted, to produce fruit the following year. But they should not be left to stand along the rows closer together than an average of one plant to a foot in length in the rows.

The plantation should be gone over several times during the summer, and the tops of the young canes, as they appear above the bearing bushes, should be shortened in so as to keep them at a uniform height of about three to five feet, according to their strength. This will induce the side branches to grow vigorously and develop fruit buds near the ground, and by interlocking with each other the bushes will support themselves, and thus avoid the necessity of stakes and wires to prevent high winds from injuring the tender canes.

The side branches should be shortened in during the following winter or spring to a pyramidal form somewhat resembling a dwarf pear tree when properly trimmed. Plants thus treated will yield more fruit and of a better quality than if left to grow tall and slender, as by nature they are inclined to do. We have sometimes left a few rows without pruning, and others pruned but little, which fully illustrated the great importance of shortening in the branches. The unpruned bushes will bear more fruit than could be ripened on them; it would remain red a long time, and finally dry up, being of no value. The best and earliest fruit would be on the bushes well pruned, so as to throw the whole strength of the roots into fewer berries. To insure good crops requires close attention; the canes should be kept thin and well headed back. On poor land an occasional dressing of manure, muck, or fertilizers of some kind adds to the quantity and quality of the fruit. The best results are obtained from young healthy plants grown from root cuttings especially for the purpose, while suckers from old and decayed patches yield but little profit.


KITTATINNY BLACKBERRY.

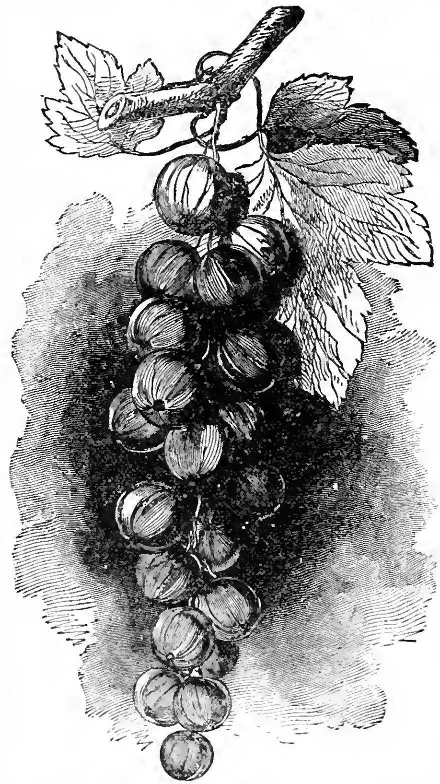
**Winter Protection.**—Some varieties of blackberries are sufficiently hardy to withstand the cold climate of Canada, and the extreme northern portion of New England without protection; others will be liable to winter-kill unless some protection is given. Severe pruning in summer renders the plants more hardy; it is best to omit (after the second year), all cultivation in summer after the time of blossoming. The surface of the ground should be stirred often to keep the weeds down, but not too deeply, for if the roots are broken, there will be a great number of new suckers sent up, which soon crowd the others. When covering of the canes is desired for winter protection, they can be more easily bent over to be covered with soil, if the earth is dug away a little from one side of the plant.

**Yield and Profit.**—The yield and profit of blackberries will of course vary with the season, market price, etc., like that of other fruit crops, but with good management the growing of this fruit may be made very profitable. An extensive cultivator of this fruit

says: "We have known some plantations to yield annually $400 per acre and upwards, for several years in succession, while others did not pay more than half that amount. Having kept a record of the yield and sale of our blackberries for fourteen years past, we find the average to be about as follows, viz.: Price fourteen cents per quart, and yield 2,200 quarts per acre, which gives the following results:

| | |
|---|---|
| Commission, at 10 per cent., | $20.80 |
| Picking 2,200 quarts at 1½ cents, | 33.00 |
| Use of boxes, | 10.00 |
| Pruning, cultivating, etc., | 34.20 |
| Net profit per acre, | 200.00 |
| Gross sales 2,200 quarts per acre, at 14 cents, | $308.00 |

Sometimes we hear of extravagant reports, calculated from the product of a small lot up to what ten or twenty acres under similar circumstances would yield. A safer rule is to take the acres, and see what they have produced. By reference to the report of the West Jersey Fruit Growers' Association, which appointed committees to collect the returns from all the fruit growers in the neighborhood, it will be found that 776 acres of land in strawberries, raspberries, and blackberries produced the sum of nearly $200,000, or about $250 per acre." Another fruit grower of many years experience expresses the following opinion: "Requiring little manure, and being as easy grown as a field of corn, the blackberry proves one of the most profitable of fruits. The yield per acre is usually from sixty to one hundred bushels, though at times one hundred and fifty bushels have been obtained. The price in some markets averages twenty cents per quart, and in others twelve and fifteen cents. Some plantations yield fruit for from twenty to thirty years, giving an income of from $100 to $400 per acre. At times $500 worth of fruit has been obtained per acre. Berries from the South have sometimes sold in the Philadelphia and New York markets as high as fifty cents per quart. At the North, forty plants have been known to yield fully eight bushels of fruit. They will give a nice little income to children when planted along fences, even if uncultivated after the first year. When grown in a green sod they often are very hardy and quite productive."



**Currants.**—The currant (*Ribes rubrum*) is a native of Britain and the North of Europe, and has been cultivated in the gardens of that region for more than a century. It is one of

the most common of our small fruits, as well as the most easily grown, and has long since been regarded as a necessary part of every garden. It is often neglected and allowed to stand year after year in the sod with no care whatever, yet under these adverse circumstances, it will produce very good crops. If properly cared for, the fruit will be much larger, and more abundant than otherwise. The currant is an exceedingly hardy shrub, usually growing from three to four feet high. The original wild species produces a small and very sour fruit, but cultivation has produced great changes, and we now have varieties the single globes of which will measure an inch and a quarter or more in circumference. The Black Currant (*Ribes nigrum*), is a distinct species, and has large leaves and a coarser growth than the common red or white varieties."

FAY'S PROLIFIC.

**Varieties.**—There are comparatively few varieties of currants in common cultivation. The standard red varieties are FAY'S PROLIFIC, CHERRY, LA VERSAILLAISE, VICTORIA (a late variety), and RED DUTCH. The WHITE GRAPE is the best white, and the BLACK NAPLES, and LEE'S PROLIFIC the best of the black varieties. Fay's Prolific is a very hardy variety and an abundant bearer; the fruit being considerably above medium size and growing in large clusters, as is shown in the illustration of this variety, which represents fruit grown by Mr. George S. Josselyn, Fredonia, N. Y. The Black Naples is an old and very large variety. It is less acid than the red or white varieties, and has a musky flavor. Being of larger growth than these, it requires more room in setting, and less pruning than the others mentioned.

**Cultivation.** — The currant is propagated with the greatest ease from cuttings which should be planted in the autumn or early in the spring. They will soon take root, and should be about a foot in length when set. Currants will do well on almost any kind of soil, but the best results require a deep, rich soil. At the South, they do best in a soil containing a mixture of clay. As a general rule, the richer the soil, and the better the cultivation, the heavier the crop, and the larger the berries. Before setting the cuttings, manure and prepare the ground the same as for any ordinary crop. Set the cuttings from three to three and a half feet apart, in rows five feet apart; this will require nearly 3,000 plants per acre. Keep the ground mellow and free from grass and weeds. Mulching during fruiting time adds to the size of the fruit, and is essential in order to secure the best results at the South, where the ground becomes parched in summer. Almost any loose material will answer for mulching, except evergreen boughs.

**Pruning.** — With proper care and pruning, the vigor of the currant plants or shrubs may be kept up for many years. The pruning essential is the thinning out of all the old canes that show signs of failing, and in cutting back annually and thinning out the new shoots from one third to one-half. This will add much to their vigor and productiveness. Pruning may be done late in the fall or very early in the spring before the buds begin to swell. Extra large berries can be obtained by pinching off the ends of the strong growing shoots about the middle of June, or when the fruit is about two-thirds grown. This causes the plants to expend all their strength and energies in increasing the size, and maturing the fruit. The fruiting season may be prolonged by shading the bushes with straw matting or sacking before the berries commence to ripen. By this means, the full ripening of the fruit may be retarded until into September or October.

**Diseases and Enemies of the Currant.** — The currant has but few enemies and diseases. The most common enemy is the currant worm (*Abraxis ribearia*), that eats the leaves of the plants, and the currant borer (*Prenocerus supernatatus*), that feeds upon the pith or wood of the young shoots. For treatment, see DISEASES AND ENEMIES OF FRUIT.

**Gooseberries.** — The gooseberry (*Ribes grossularia*) that is cultivated in our gardens, is a native of northern Europe, the wild species growing in this country not having proved very valuable for culture. It is grown much more extensively in some portions of Europe than in this country, although it is receiving more general attention at present here, than formerly. Great improvements have been made of late in the American varieties, which may be said to constitute a new era in the culture of this valuable fruit, which is excellent for making jellies, pies, canning, and other household purposes, while it bears transportation well, when sent to market.


GOOSEBERRY.

**Varieties.** — The principal varieties of the gooseberry are the DOWNING, HOUGHTON'S SEEDLING, SMITH'S IMPROVED, and the AMERICAN SEEDLING. These are all hardy and productive. The cut of the Downing is a good illustration of this variety, and is copied by permission from the catalogue of Mr. R. H. Haines of Moorestown, New Jersey. Gooseberries when in a green state are in good demand in the markets, while when fully ripened they are a very delicious fruit.

**Cultivation.** — The gooseberry requires about the same general treatment as the currant, but rather more care, and the same directions respecting planting, growing, mulching, pruning, currant worms, etc., will apply to its culture. It is a gross feeder, and requires a rich soil, — a rich, moist loam, if not too wet, being regarded as the best. Drouth is very injurious to the plants, and for this reason heavy mulching is very beneficial. The pruning

DOWNING'S GOOSEBERRY.

should be such as to give the plants plenty of air, as mildew often results from overcrowding. The plants will not bear well for more than five or six years; the setting out of new plants every year or two is therefore to be recommended, in order to have a constant supply of young and vigorous plants for bearing. The north side of a building or fence will often prove a good location for growing this fruit, thus affording a partial shade, and resulting in the growth of larger berries.

**Diseases and Enemies.** — The mildew is the most common disease to be met in the cultivation of the gooseberry, while the currant worm is the principal enemy. (See Diseases and Enemies of Fruit.)

**Cranberries.** — The cranberry is a semi-aquatic plant found growing wild in swampy, sandy meadows in the northern portion of both the Eastern and Western hemispheres. The American species is much larger and finer than the European, which is greatly inferior to the former. both in size and quality. The cranberry is highly valued for its fruit, which is quite acid, and is useful in making tarts, preserves, and for other culinary purposes. In many portions of New England, 'New Jersey, on Long Island, and other sections of the country, low, marshy meadows of but little value have been drained and made to bring very profitable returns by utilizing them for the cultivation of this fruit. From the Northwest, especially in Michigan, Wisconsin, Minnesota, and Northern Indiana, there are vast tracts covered with cranberry vines growing wild. By cultivation, this fruit has become greatly improved in size, quality, and productiveness, and in many portions of the country has become an important and profitable industry. Although the cranberry thrives best on land that is covered by water a portion of the year, yet there are some varieties that do fairly well on uplands where the soil is moderately dry.

**Varieties.** — There are but few varieties of the cranberry in cultivation. Among the best may be mentioned the Mansfield Creeper, a variety suited to upland culture, and is quite productive, with berries of good size. For lowland culture the Black Bell, a large variety, well shaped, of very dark, bright-red color; the Large Cherry, a good sized, oval variety. Besides these, there are other kinds of the common "Cherry" and "Bell" varieties that are cultivated to a considerable extent. No especial pains have yet been taken to improve varieties of this fruit on scientific principles, but no doubt great improvement could be accomplished in this direction.

**Culture.** — There are probably few, if any, fruits cultivated that will grow on so great a variety of soils as the cranberry. A New England writer well skilled in the culture of this fruit, says respecting it: "While it seems to be natural for the cranberry to grow on land that is very wet during the largest portion of the year, it will grow better on high land than it will where the land is wet all of the year. From the time of blossoming until the fruit is ripe it flourishes best where the ground is hot and dry. The most profitable and the best location seems to be a meadow that has a peat bottom that can be flowed with at least two feet of water during the winter and spring, and can be thoroughly drained in the summer. In such location the cranberry can be grown with as much profit as any other fruit; but if one has no meadow, and desires to have a few cranberries for his own use, it is very easy to grow them on high, dry ground; in fact, we have seen them grown at a profit on good corn land by the side of strawberries; the products of three-quarters of an acre being sold the third year after setting for $300.

The greatest trouble in growing them on high land is in keeping the ground free from weeds and grass. The vines have to be reset much oftener on high than they do on low land, but the fruit is much more valuable, being hard and thick flesh, with very small hollow cavities for the seed, and the keeping qualities are much better, oftentimes keeping more than

a year without any particular effort except to keep them in the dark and where they will not freeze. For many years we have had old cranberries in good condition when the new ones were gathered.

In setting vines on high land it is important that the roots should be set all over the ground, and not in rows, and if the land can be mulched with sawdust, leaves, or any material through which the little roots of the runners can penetrate, it will not only assist in keeping the grass out, but save the runners from being scorched by the sun. Half a rod of land in one corner of the garden, well cared for, will furnish fruit enough to supply an ordinary sized family.

If one has a pond that flows up several feet higher in the winter than in the summer, by filling in the borders with sand a good crop of cranberries can be grown for many years, without any expense after the first two or three years, except that of harvesting the fruit; in such location, good crops of fruit will grow on four feet of sand, and to our knowledge will continue for more than twenty-five years without resetting.

In such locations the water protects the vines in the winter, and where it does not leave the vines until the last of May or the first of June it protects the blossom buds against the spring frosts, checks the growth of grass, and at the same time gives to the vines just the fertilizing material they require. He who desires to enter largely into the cultivation of cranberries should not be satisfied with high land, or the borders of a pond, but should look around until he finds a piece of land naturally fitted for the cranberry, and thus avoid heavy and constant expense. When such location is found, it will be a meadow with a peat bottom or never-failing stream of water flowing through it; the land so situated that it can be covered with water in a few hours at any season of the year, and kept covered at least two feet deep from December to May; also within a short distance of a sand hill.

When a piece of land of this description can be found, it is cheap at any price under five hundred dollars per acre, and even at five hundred dollars it will pay a very large profit if set with cranberries. In preparing the land, it is best to remove the sod down to the peat, which in most locations will be worth, for manure, more than the cost of removal. The land should then be covered with at least four inches of sand; this can be done best and cheapest in the winter, when the ground is frozen and the work of the men and teams is not so pressing. The vines should be set in May as soon as the weather begins to be warm; if the water can be brought to within an inch of the top of the sand, the vines can be set with greater ease, and will be much more likely to live; whatever may be said to the contrary we believe it is always best to set vines that have roots. We have seen plantations set with vines that had been run through a hay cutter, under the direction of one who believed that the tops were as good as the roots, but the result was a complete failure. The vines do best to set them in single roots, being first entirely freed from grass; the distance apart should not be over six inches each way. If the water is just the right height, the vines can be scattered over the sand and the roots pressed in with the fingers. Never set in rows two or three feet apart, for by so doing the vines will always be uneven, because by the time the ground is covered between the rows the vines in the rows become old, with many dead vines, but if the vines are set all over the ground, by the second or third year the ground will be well and evenly covered with young, vigorous vines.

There is a worm similar to the plum curculio which sometimes attacks the young fruit that grows on land that cannot be kept covered with water during the winter; as the perfect insect winters near the surface of the ground, the water probably destroys it. It is very important to keep the weeds and grass out the first two or three years; after that time, if the land is well adapted to the fruit, but little attention will be required, except to keep the land flowed at the proper time. As the weeds and grass must all be picked out by hand, the first year requires considerable time and the second year will require more time than the crop

will be worth, but it pays in the end to keep the vines entirely free from both weeds and grass. There is a great difference in varieties, both as to the quality of the fruit and the bearing qualities of the vines; some varieties are small with thin flesh, while others are large with thick flesh, the last-named being the most desirable. No large plantation should be set without a positive certainty that the vines that are set are abundant bearers; for while some varieties produce more than three bushels to the rod, others do not produce as many quarts. If one can do so, it is always best to select vines by a personal examination when the fruit is on them, and not depend on the recommendation of any one.

**Gathering.**—Cranberries, when grown extensively, are generally gathered with a fine rake, or a raking machine made for the purpose, a single man being able to gather thirty bushels or more in a day, when the vines are in full bearing. Some of the berries are apt to be injured, however, by this process, by coming in contact with the teeth of the rake, but when the berries are to be used in a short time, this is no serious objection. When the berries are to be kept until the following spring or summer, they should be picked by hand, as the bruising from the rake will cause them to decay. They will then keep for months in a dark place, as cold as possible without freezing.

**Mulberries.**—The mulberry tree is not cultivated very extensively in this country, but it is really quite an acquisition to our summer fruits, and is well worthy a place in every garden. The fruit resembles the blackberry in appearance, but is less tart, and has less pronounced flavor. It is used the same as blackberries and raspberries are. It ripens in July, very soon after the cherry season is passed, the fruit easily dropping upon the ground when fully ripe. With some varieties the tree grows very rapidly, bearing when two years old, and often attaining a height of forty-five or fifty feet. On account of the fruit dropping as soon as ripe, a clean, short grass turf is generally kept under the trees, so that the fruit may be easily picked up uninjured. The principal varieties are the Russian, a fine hardy variety, berries sweet with sub-acid taste, and fine flavor, black or reddish white when fully ripe; the Black or English variety is of slow growth that seldom attains a height of more than fifteen feet; it is, however, very long lived, specimens being found in England that are said to be 300 or more years old. The fruit is large and fine, but the tree is not as hardy as some varieties, and will not well endure the cold winters of a region north of the State of New York. The Everbearing originated from the seed of the Multicaulis, and is a fine, hardy variety; fruit an inch and a quarter in length, and nearly half an inch in diameter, color blue-black at full maturity. It continues bearing a long time. Johnson's Seedling is also a fine, hardy variety.

**Cultivation, etc.**—The mulberry is very easily propagated from cuttings, and thrives best in a rich, sandy loam. The tree requires little or no pruning, and is easily cultivated. The cuttings are usually about three feet in length, planted about half their length in the soil in the spring.

# DISEASES AND ENEMIES OF FRUIT.

IN the animal and vegetable kingdom, every creation seems to have its peculiar diseases and enemies to combat and overcome, or to be overcome thereby; thus we find that every animal and plant has its parasites, which by their depredations may so deplete the natural vigor as to induce disease and sometimes destroy life itself, while these parasites are themselves frequently subject to other parasites that prey upon their vitality in the same manner, and still the latter minute parasites have parasites of their own, and so on; thus in the great economy of Nature there is ever a tendency to maintain a balance of power, when the laws that govern it are not in any way interfered with. A large majority of the diseases of plants are caused by parasites of some kind; in fact, insect enemies and diseases are so closely connected, and their relations to each other are such, that it is often difficult for the farmer and fruit grower to determine to which source to attribute his losses.

Professor A. S. Fuller says in this connection: "Some species of insects attack only diseased or dead plants; others only the living and healthy. If a plant shows signs of failing, we are inclined to speak of it as being diseased, whether the failure is caused by a lack of some element in the soil, attacks of parasitic fungi, or noxious insects. The loss is the same in the end, whether from one or all of these enemies combined. There are two practical methods of combating insect enemies and diseases of plants; one is to cultivate so carefully and stimulate the growth of the plants that they may possess the power of resisting attack; the other is to make war directly upon them by artificial means. Of course, the first method is most applicable or practicable against the more minute species, such as plant-lice, rust, smut, and mildew. I do not recommend forcing plants to extremes, in order to enable them to resist their enemies, as this might work an irreparable injury; but the condition to be aimed at should be a healthy, vigorous growth; for anything beyond this is more the sign of weakness than strength.

The half starved, over-worked, and uncared-for horse is sure sooner or later to become the prey of various internal and external parasites, which are thrown off, or their attacks successfully resisted by the healthy, vigorous, and well-fed animal; and the same principle holds good all through the animal and vegetable kingdom—whether the subject be a man, horse, sturdy oak, or delicate strawberry plant. Not that all diseases are due to loss of vigor through starvation and neglect; but that a large number of them are, is well known. The experience of the grape-grower of France with the Phylloxera is one of the most remarkable instances on record of the success of what may be termed the 'resistant methods' of combating insect enemies. After having searched in vain for many years to find some practical method of destroying this pest, Professor Riley in his remarkable investigations in this country discovered that some of our native American varieties were capable of resisting it, *i. e.* of growing vigorously notwithstanding the presence of the lice upon their roots. This discovery opened a way out of the difficulty, and the French are successfully availing themselves of it by using our resisting species, as stock for their more susceptible kinds. The Grape Phylloxera is more or less abundant in all of our vineyards, but owing to the rapid and vigorous growth of most of our native varieties, it does comparatively little harm. But we have many kinds of insects that attack our small fruits that cannot be controlled upon this resistant system, and we are compelled to combat them in a more direct and vigorous way."

We find that with all vegetable growths, good cultivation and such treatment as tends to promote a vigorous growth and development of the plants, has a tendency to ward off disease and enable the strong vital forces to resist the attacks of such insects as might otherwise cause serious damage. Some classes of insects may be driven away or destroyed by suitable measures, while many of the diseases may be checked, if the proper treatment is

adopted in season, while there are a few diseases the cause of which, as well as the remedies, are still unknown, notwithstanding the efforts of our most skilled naturalists in investigating to ascertain. Some of the principal diseases and enemies of the larger fruits are as follows:

**Aphides.**—This is the name applied to numerous insects of the family *Aphidæ* commonly known as plant lice, that live upon the leaves of fruit trees, often doing great injury, some species of this genus being very destructive, such as the hop-fly (*Aphis humuli*) and the aphis of the turnip and cabbage (*Aphis brassicæ*). The Aphides are themselves often infested by certain minute parasites, which by laying their eggs in the bodies of these insects cause the destruction of vast numbers, while these minute parasites have in their turn parasites whose eggs are deposited in their bodies, causing the death of quite a large proportion of them. Fruit trees are frequently so injured by Aphides that they are almost worthless for fruit production, these insects collecting in large numbers upon the under side of the leaves and the tender and succulent shoots, in fact there is scarcely any part of the plant that they do not attack, sometimes completely covering the leaves, buds, and tender shoots. They frequently attack cherry and plum trees in this manner, and by sucking the juice retard the growth, the leaves curl and wither, and the formation of the fruit is checked. Throwing a spray of strong soap suds over the tree with a fountain pump or large syringe or atomizer designed for such purposes, will usually prove effectual. It may be necessary to repeat this operation several times before they are all exterminated, as they increase very rapidly, and may not all be destroyed at the first application. Wood ashes thrown upon the leaves when they are wet with dew, or after a shower, will also answer the same purpose.

**Apple Worm.**—This worm is hatched from the eggs of the insect known as the "codling moth," (*Carpocapsa pomonella,*) and often proves quite destructive to the crop of apples and pears. The moth lays its eggs at the blossom end of the young fruit. In a short time the eggs hatch, and the worm—a reddish white—burrows its way to the core of the fruit, causing it to ripen prematurely and fall to the ground; also greatly injuring much of that which remains on the trees. After the fruit falls, the worm leaves the fruit and crawls into the crevices of the bark and hollow parts of the tree, where it spins a cocoon, where it remains until spring, when the young moth appears. The method of destroying this worm, and consequently the moth, is to permit sheep or swine and poultry to run at large in the orchards when the fruit is falling; or to have the fruit picked up each day and placed where the worms will be destroyed.

The method practiced by some is to wind a band of hay or cotton flannel cloth around the trunk or branches of the tree, into which the worms will be liable to go, and spin their nests as they come down from the fruit, after which they may be destroyed before they hatch out. Old cloths, placed in the crotches of the trees, may also serve as traps to catch them. Torches, or small fires lighted in orchards, in May and the early part of June, just at the edge of evening when the moths are flying about, will attract many of them into the flame, where they will be destroyed. Another plan is to place a lantern or lamp inside of a tarred barrel or against boards smeared with tar for the same purpose.

**Bark Louse.**—This insect attacks the bark of young apple and pear trees, and often proves quite destructive. It makes its appearance on the smooth bark, looking like a small brown scale or blister about an eighth of an inch in length, being oblong in form. This scale or blister is the dried remains of the body of the female covering and protecting her eggs, which will be found underneath from a dozen to a hundred in number. The eggs hatch the last of May, the minute dull white insects sometimes nearly covering the bark, which they puncture for the purpose of sucking the sap. Scraping and scrubbing the bark in summer with a stiff brush in strong soap suds with a mixture of kerosene oil, rather warm, will prove very beneficial. Another excellent remedy is to apply to the bark early in spring an equal mixture of tar and linseed oil quite warm, but not hot enough to injure the tree.

**Blight.**—This is one of the most formidable diseases with which the fruit-grower has to contend, and is generally regarded as incurable. It attacks the pear, apple, and quince, but proves the most destructive to the pear. The disease is characterized by the withering and turning black of the leaves of some of the most thrifty branches, this condition sometimes extending over the entire tree, causing the leaves to wither and fall, even in midsummer. The disease is quite liable to extend to the branches, the wood becomes shriveled and hard, and in a short time turns black, and if allowed to remain on the tree, will be liable to extend to the trunk. There are two distinct diseases known as the blight,—the Insect Blight, supposed to be caused by a minute insect, the larva of which bores into the wood, perforating it; the other, a blight supposed by many to be caused by the freezing of the sap in the wood, the theory being that when the trees have not fully matured their growth of wood, or, after having dropped their foliage permanently, a few warm days cause the sap to ascend the branches again; the sap is afterwards frozen during the severe winter, and thus produces the diseased condition.

This opinion was formerly entertained by some of our best authorities on fruit growing, and prevails at the present time to a considerable extent. It is the opinion of Prof. Caldwell of Cornell University, Prof. Burrill, and some others, that the blight is caused by bacteria, which are small microscopic organisms not over 1-8000th of an inch in length, nor of 1-16000th of an inch in breadth. It has not been fully decided whether they are animal or vegetable, but are generally thought to be vegetable growths, and increase with prodigious rapidity under favorable circumstances. A pruning knife, used on a diseased tree, may convey the disease to a healthy one, it being easily conveyed from one to another by such means, as well as by various other methods. The best remedy for the difficulty is to cut off the portion of the trees which are infested, but the work must be done in the early stages, as well as *thoroughly* done, for the bacteria may have passed three or four feet from the portions of the tree which show visible signs of having perished. As soon, therefore, as the disease makes its appearance, the affected branches should be cut considerably back of the discolored wood, and be immediately burned, as the disease may be communicated to others by means of the fungus growth in the sap, which may be easily perpetuated.

If the affected branches are not cut off considerably below the point to which the disease extends, the evil will not be entirely removed, as the diseased sap remaining will extend it to other parts of the tree. The pruning must be severe and be kept up until the disease is entirely checked. When the entire tree seems to be involved, the better way is to cut it down and burn it, root and branch, to prevent the spread of the disease. A prominent agricultural journal gives the following on the pear blight:

"It has been shown by careful microscopic examination, in its earliest stages, that this disease is caused by a minute fungus which develops in the bark and penetrates inwardly, destroying the cell structure as it proceeds. The fungus is so small that the distinguished investigator, J. Gibbons Hunt, under a powerful microscope, could not distinguish the species, but this is of no consequence. This being the cause of the disease, the preventive is obvious. Any one who is in a neighborhood liable to blight can have immunity by washing his trees annually with pure linseed oil, sulphur wash, or other things that will kill a fungoid spore without injury to the bark. Of course many get into a crevice where the washes cannot reach, and hence there may be some cases where, even though the trees be washed, there will be disease. The cause of the disease has been so clearly demonstrated, and the remedy so patent, that cases of 'fire blight' only prove ignorance or neglect.

Since the above was written, the writer has seen a beautiful row of Dwarf Duchesse d'Angoulême pears on the grounds of Mr. Hiram Sibley at Rochester, one of which was badly stricken by fire-blight, though he was told the trees were sulphur and lime washed every

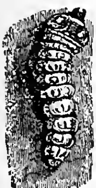
year. But on personal examination of the trees it was found that only the trunk up to the branches was washed, and this, of course, could have no influence on the parts not covered by the wash"

Washing the branches with solutions of potash, lime, copperas, soft soap, or carbolic acid, is often used with good effect in stopping the progress of the blight in its early stages. The washes previously recommended are also regarded by many fruit growers as a *preventive* of the blight, if applied quite early in the spring. Soils that are very wet should be avoided; also manuring too heavily where the land is already quite rich, lime, wood ashes, or bone dust being better under such circumstances than barn-yard manure. Heavily mulching the trees during the summer and fall is also excellent. Unless trees affected with the blight receive prompt and thorough attention, the disease will be liable to spread rapidly.

**Black Knot.**—This is a disease that attacks apple, plum, and peach trees, and is characterized at first by an irregular swelling on the limbs or trunk of a tree, which continues to increase year by year until it cracks, and resembles irregular black lumps, with a hard, uneven surface. This stops the circulation of the sap upwards, and seems to poison the sap that is disseminated downward, causing the whole trunk to become diseased. The cause of this evil is supposed to be the work of an insect. The best remedy that has ever yet been found is to cut away all affected limbs a few inches below the limit of the disease. When it appears upon the trunk or largest limbs, it will have to be cut or dug out, and care taken to remove every particle of diseased wood.

The wound should then be washed with a solution of chloride of lime, or spirits of turpentine, to prevent the farther growth of the fungus, and afterwards (if the limb be large), covered with shellac varnish, liquid grafting wax, or paint.

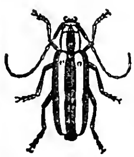
**Borer.**—There are various species of borers that attack apple, pear, quince, cherry, peach, and other fruit trees by entering the tree near the ground (usually just below the surface), and cutting their way through the wood and under the bark, sometimes completely girdling a tree. They are dangerous enemies of fruit trees, their presence often not being detected until the tree is nearly destroyed. The eggs are laid under the loose portions and scales of bark, the insects commencing to eat through the bark almost as soon as hatched. They remain and feed upon it for several months, and finally work their way into the wood. This stage of their progress may be detected by the powder that is seen coming from the bark where they are at work.


a

SAPERDA CANDIDA.
*a*, larva.


b

S. BIVITTATA.
*b*, pupa.

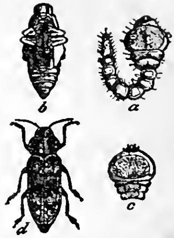

c

THE ROUND-HEADED APPLE-TREE BORER.
*c*, beetle.

The round-headed apple-tree borer (*Saperda candida*) is one of the most injurious to apple orchards, being rivaled only by the flat-headed borer (*Chrysobothris femorata*). According to Prof. Riley this insect remains in the tree three years from the time it is hatched. Mr. D. B. Weir of Illinois, who has made a thorough study of this species, says:

"As soon as hatched the young grubs begin to gnaw their way into the bark of the teer by means of strong, sharp jaws. They do not usually penetrate directly through, but reach the liber or inner bark half an inch distant from the point of entrance. In their passage through the bark they shove their excrement and refuse out through the opening of their burrow, and being of a glutinous nature it collects around its mouth in a mass as large as half a bean, or in the shape of a tear. These excretions are usually of an orange color, and are at once recognized by the experienced eye.

The great majority of young larvæ reach the inner bark about September 1st, and have generally all reached it by October 1st. The first half of October is the best time to search for and destroy them. Until that time they have done but little, if any damage, and their location is readily detected by their excretions on the trunk of the tree. They are readily found and despatched by shaving off the outer bark with a sharp knife. My plan of operation has been to go over my orchards each July or August, and with a sharp hoe clean any weeds, grass, or other litter and a little soil from around the trunk of each tree, and then in October search carefully and kill the borers."




CHRYSOBOTHRIS FEMORATA, Fab.:–Flat-headed borer of the apple-tree, and of the soft maple: *a*, larva; *c*, head of larva, underside; *b*, pupa; *d*, beetle.

The beetle of the flat-headed borer makes its appearance in May or June, and is said, as a rule, to attack only those trees which have their health impaired, or have been injured in some way; also trees overpruned, and those transplanted above the proper size for such a change being more liable to the attack of the borer than those which are undisturbed; hence it follows, as a natural consequence, that keeping the trees in a healthy condition is one of the best methods of preventing the attacks of this insect. Various measures are resorted to as a preventive of the attacks of borers. Kerosene oil applied about the lower part of the trunk, in the early part of June, scraping away the soil for this purpose, is a very good remedy; also to hollow out the soil four or five inches deep, making a basin, and pouring two or three gallons of hot water, is very effectual and safe with bearing trees, but for young trees it is better to apply some other remedy, such as the use of wire to run into the hole made by the insect, and crush it to death. This method is, however, not always effectual, as the channels eaten by the worm are frequently very irregular. Scraping away the earth and the trunk, and heaping up ashes around the tree will often prove quite successful in keeping the borer from making a lodgment.

A wash made of half a gallon each of soft soap, hot water, and six ounces of carbolic acid, with ten gallons of cold water afterwards added, applied early in June, will also prove effectual. Whitewashing, painting with a mixture of soap, lime, and Paris green; also applications of coal tar have been tried with benefit. Cutting out with a sharp knife before the borer enters the wood may be easily accomplished, and the use of a wire to run into the holes made in the wood, will prove effectual when the insect can be reached.

**Canker-Worm.** — The canker-worm (*Anisopteryx pometaria*) is a very destructive enemy, attacking both the fruit and leaves. The eggs from which this worm is hatched are laid by a moth nearly destitute of wings. This moth commences to ascend the trees early in spring, generally in March, laying a number of eggs, from which the brownish, yellow-striped canker-worms are hatched about the middle of May. To prevent the moth from climbing the tree, a cloth band coated with tar, printing ink, or a mixture of tar and oil is frequently fastened around the trunk of the tree. This mixture will need to be renewed every few days, or it will become dry. In attempting to pass this obstruction, the insects are caught by the moist, sticky surface, and die, or may be easily caught and destroyed. Another method is to nail a rope around the trunk of the tree, and afterwards nail a strip of tin five or six inches wide on the rope, or around the trunk, with the lower edge outward. The canker-worm may be driven out of trees that have fruit, by syringing them with a solution of warm lye made of wood ashes and a little kerosene oil. Strong soap suds will also prove effectual.

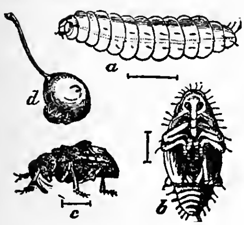
**Caterpillar.** — Caterpillars are a great pest in an apple orchard, frequently proving very destructive to the crop. The common or "teut caterpillar" (*Clisiocampa americana*) is the offspring of a reddish brown moth of medium size. These insects are seen in great numbers in midsummer, flying only at night, aud often enter houses in the evening, being

attracted by the light. They lay their eggs principally in the apple and cherry trees, depositing them by thousands around the forks and extremities of the young branches. About the middle of May these eggs hatch, and the young caterpillars come forth in myriads, and weave their nests or tents among the forks of the branches, feasting upon the leaves, sometimes entirely divesting trees of their foliage, the effect of which is to stunt the growth of the fruit and wood, enfeebling the tree, and sometimes, if unmolested for a few seasons, entirely destroying its life. They remain in the caterpillar state for six or seven weeks. The best time to destroy them is in the morning before nine o'clock, or towards evening, when they will be in their nests. They can be easily taken from small trees and crushed. On large trees, it is a very easy matter to burn them in their nests with a torch of some kind attached to a long pole. Another very effectual method is to fasten a sponge to the end of a long pole, and, wetting it with strong liquid of ammonia (hartshorn) or naphtha, turn it slowly in among the nests, attaching them to the sponge.

**Cherry Slug.** — This often proves very injurious to cherry and pear trees. It is snail-like in appearance, about half an inch in length, has a smooth, shining, and jelly-like skin, and is of a dark greenish-brown color when filled with food. Dusting the trees with dry wood ashes when they are wet with dew will usually exterminate it, or syringing the trees with strong soap suds.

**Codling Moth** (*Carpocapsa pomonella*). — This is a grayish-colored moth marked with brown, and is about half an inch in length. Its eggs produce the common apple worm. For directions for destroying it, see Apple Worm.

**Curculio.** — The plum curculio (*Conotrachelus nenuphar*) is doubtless the most destructive weevil with which the fruit grower has to contend. It attacks the fruit of the plum, nectarine, apricot, cherry, peach, apple, pear, and quince, by making a little crescent-shaped incision, in which it deposits its eggs; it also deposits in the black knot of the plum tree. It seems to be more destructive to the plum than to any other fruit; the raising of plums has become almost entirely abandoned in some sections of the country, owing to its ravages. It is described by Prof. Thomas, of Illinois, as follows: "It is of a dark brown color, variegated with spots of white, ochre-yellow, and black; the snout is rather longer than the thorax; the surface of the latter is uneven; the wing cases have two shining black humps or tubercles on them, one on each case, about the middle, close to the suture; behind these is a broad band of dull yellow and white; each thigh has two little teeth on the under side. It varies in length from a little over one-eighth to one-fifth of an inch. When disturbed, it has a habit of drawing up its legs, and bending its snout under its breast, when it is easily mistaken for a knot or wart on a limb or fragment of bark. The beetles usually come forth from their winter quarters in May and June, some appearing in the southern part of Illinois as early as April, and from that time on during the season as late as June, according to the latitude and the season. The female, when about to deposit her eggs, makes a minute cut with the jaws at the tip of her snout, and, thrusting her snout into this opening, enlarges it sufficiently for the reception of an egg. Then turning round she drops an egg into the opening, which she afterwards thrusts to the bottom of the cut with her snout; then cuts the crescent around one side of the orifice. One egg only is deposited in an opening, which is elongate-oval in form, about three-hundredths of an inch long, the diameter being about one-third the length; it is of a pearly white color. Each female is supposed to have a stock of from fifty to one hundred eggs, and to deposit from five to ten a



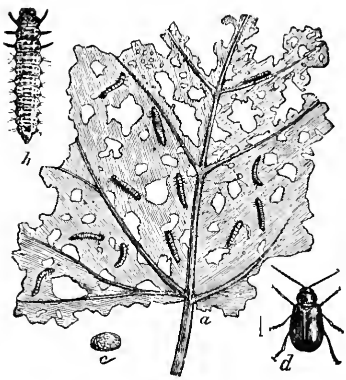

CONOTRACHELUS NENUPHAR (HERBST).

Plum and peach curculio—*a*, larva; *b*, pupa; *c*, beetle; *d*, a plum, showing the crescent slit made by the female after depositing her egg.

day. While those which appear earliest begin this work about the middle of May, it is continued by others which appear later, until the last of June or the first of July, thus extending the period of egg depositing to about two months.

The larva which is hatched from the egg, is a little footless worm, somewhat maggot-like, except that it has a distinct head and is less attenuate at the extremity; is of a glossy yellowish-white color, but partakes more or less of the color of the flesh of the fruit in which it resides; there is a lighter line running along each side of the body, with a row of minute black bristles below, and a less distinct one above it; the stomach is rust red or dark brown, the head yellowish or pale brown. Length, when full grown, about two-fifths of an inch. The fruit containing this grub does not usually mature, but falls to the ground before it is quite fully grown. When it has completed this stage it leaves the fruit now on the ground, and burrows a few inches into the earth, where it remains in the pupa state." In the following spring it emerges from the ground a perfect beetle, and renews its attacks on fruit. The most effective method of destroying this insect is to permit the chickens to have free access about the orchard. This has been found to be a *sure* remedy in numerous instances, the young chicks eagerly destroying the insects. The case of a gentleman who abandoned his plum orchard, owing to the ravages of the curculio, and using it for a chicken yard, has already been mentioned. Leaving the plum trees simply for a shade, he was astonished to find that every year after the chickens occupied the yard he had a good crop of plums. We know of no remedy more effectual than this for protecting the plum orchard from this insect. Dusting with wood ashes frequently when the leaves are wet, smoking the trees with petroleum, leather, or woolen rags are sometimes beneficial; also spraying the young plums with soap suds. Picking up all the fruit that falls, and burning it, placing sheets or blankets underneath the trees, and suddenly jarring the trees, by which means the insects, after falling, may be killed, are all more or less effectual in getting rid of the pest. The best time for jarring the trees for the purpose of capturing the insects is in the morning, when they are quite sluggish, and may be easily caught.

**Grape-Vine Flea Beetle.** — This insect is very destructive to the grape-vine in some sections. Prof. C. V. Riley says of it: The beetles which hibernated begin their destructive work in the spring as soon as the buds commence to swell, and it is at this early period that the greatest damage is done by the beetles boring into and feeding on said buds. Later in the season the beetles feed upon the leaves, and upon these, in the month of May, the female lays her small, orange-colored eggs in clusters. These soon hatch, and the young dark-colored larvæ soon riddle the leaf, as shown in the cut (*a*), or when very numerous completely devour it, leaving only the largest ribs. In about a month the full-grown larvæ (*b*) descend into the ground, where each forms a small earthen cell (*c*), and changes to a dull yellowish pupa of the shape normally assumed in this family. The perfect beetle issues about three weeks later, from the middle of June to the middle of July, and again begins to eat the leaves, but the damage done to them is trifling compared with that done in early spring. So far as we have observed, there is but one annual generation, but it is probable that in the more Southern States there will be two. As soon as cold weather approaches, the beetles



GRAPE-VINE FLEA-BEETLE.

*a*, leaf, with larvæ, natural size; *b*, larva, enlarged; *c*, cocoon; *d*, beetle, the swollen hind thighs not shown (after Riley).

retire under fallen leaves in the ground, at the base of trees, under loose bark, in houses, in short, in any place which offers shelter from the cold.

In considering the best means of preventing the injuries of this insect, it must be borne in mind that, according to our observations, the female beetle deposits her eggs by preference on the leaves of the wild grape-vines, as the larvæ are rarely met with in cultivated vineyards. It is against the perfect beetle, therefore, that we must direct our efforts at destruction; and while it is undoubtedly desirable to keep the vineyard clear of rubbish in winter time, by burning wherever fire can be used safely, this means of destruction loses much of its importance by the fact that the beetles hibernate in the woods and in any number of other places where they cannot be destroyed by fire. Dry lime and hellebore, which may be used to advantage against the larvæ, have proved useless against the beetle, while lye and soap suds cannot be used strong enough to kill it without injurious effects upon the plant. Tin pans or pails with some liquid at the bottom have been used to advantage for collecting the early beetles, which could be knocked into them, and we have repeatedly advised for this and other insects like the Grape-Vine *Fidia,* which fall to the ground upon disturbance, the use of sheets along the trellis to catch them. Unless repeatedly shaken from such sheets into vessels containing liquid, the beetles will of course soon escape.

The wonderful efficacy of kerosene in destroying insect life has long been known. It was used three years ago with excellent effect in shallow tin pans, or on stretched sheets of cloths, for the destructive locust of the West, and we strongly recommend its use in a similar manner for the destruction of the Cotton Worm, when brushed off from the plants.

Mr. L. G. Howard, Assistant Entomologist to the Department of Agriculture, has employed it successfully on sheets against the Grape-Vine Flea-Beetle, finding it so satisfactory that he did not hesitate to recommend it in the following terms: "Take two pieces of common cotton sheeting, each being two yards long and half as wide; fasten sticks across the ends of each piece to keep the cloth open, and then drench with kerosene. Give the sheets thus prepared to two persons, each having hold of the rods at opposite ends of the sheets. Then let these persons pass one sheet on either side of the vine, being careful to unite the cloth around the base of the vine; then let a third person give the stake to which the vine is attached a sharp blow with a heavy stick. Such a blow will in nearly every case jar the beetles into the sheets, where the kerosene kills them almost instantly.

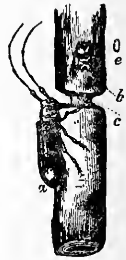
This process, after a little experience, can be performed almost as rapidly as the persons employed can walk from one vine to another. The expense necessary is very trifling, and boys can do the work quite as well as men. Warm, bright afternoons are the proper times for this work to be done, and it should be performed faithfully every sunny day until the vines are out of danger."

**Mildew** is a disease which frequently attacks the grape and the gooseberry, also the peach, but the latter only to a limited extent. This disease is supposed to be due to the growth of a very minute fungus. The best preventive of the disease is to keep the plants in a healthy, thriving condition by giving them all the elements of plant growth that are essential to this condition, with a sufficient amount of air and sunlight among the vines and foliage, by planting far enough apart to secure this object, and by proper pruning. Potash is supposed to be a necessary element of growth for the grape, and where this element is lacking in the soil, it should be supplied as a fertilizer in the form of wood ashes, or some other material. It has been found by experiment, that where there was a lack of potash in the soil this disease was more liable to prevail, but when a liberal amount was supplied, the disease subsided. It is also apt to be more prevalent in some seasons than others; for instance, when the weather is warm and moist; but some varieties are less subject to this disease than others, being better able to withstand it.

As soon as mildew appears, dust the vines with wood ashes and sulphur in equal

quantities, this treatment to be repeated every week or two as long as it continues. Another remedy said to be effectual, is to sprinkle the vines just before the buds begin to start, with a solution of sulphate of copper (*blue stone or vitriol*). By planting the vines sufficiently far apart and giving good culture, there will be little trouble with this difficulty. For mildew in gooseberry culture, it is well to have the bushes set where they will be partially protected by shade during the heat of the day. Carefnl pruning so as to keep the branches about six or eight inches apart will also prove beneficial. Sprinkling the bushes with weak lime water, also scattering lime, salt, and sulphur upon the ground quite liberally under the branches is also highly recommended. Heavily mulching with coal ashes is also said to be quite effectual.

**Twig Girdler.** — This insect is troublesome in some sections, it being known to girdle a number of trees of different kinds, such as the pear, apple, peach, plum, persimmon, elm, hickory, etc. Professor Riley says of it: "Both sexes of the beetle feed upon the bark of the hickory, but only the females, so far as we are aware, girdle the twigs. After partly girdling a particular twig, she lays a number of eggs in the distal portion that has been killed, each egg usually inserted just beneath a bud. The twig usually, though not always, breaks off by the force of the wind during winter, and the larvae flourish upon the dead wood as it lies upon the ground, burrowing just beneath the bark, and when very numerous leaving little else than the outer bark. The beetles do this work in the fall of the year. The young larva hatches and works a short distance into the twig before winter sets in, and continues working through spring and summer, transforming to pupa only towards summer. Some writers have stated that two years are required for its development. While this may be true farther north, it is not true of the latitude of St. Louis, where we have reared the insects repeatedly from the egg.



TWIG GIRDLER.

ONCIDERES CINGULATUS: *a*, beetle girdling; *b*, point where egg is inserted; *c*, form of girdle; *e*, egg.

Spraying or washing the branches with strong soap-suds mixed with kerosene oil will prove effectual in destroying the insect; also by picking up and burning all the twigs that have been broken off at the point girded, will be the means of destroying a large number of the larva.

**Rose Bug.** — The rose bug frequently does great damage by eating the blossoms and leaves of grapes, apples, etc., as well as those of the rose. The best means of driving it away, is to apply Pyrethrum powder, either in solution or in powder. This is a very simple, economical, and efficient remedy; the bulk of the powder is easily dissolved in water, and may be applied with a large atomizer in fine spray in the proportion of a quarter of pound of the powder to three or four gallons of water. This solution is most effectual when first made, and looses strength the longer it is kept, consequently it is always best to use only that which is fresh made, or has not been mixed longer than a day or two. When applied in a powder, it may be mixed with five or six parts of wheat flour, and lightly sifted over the vines. This powder can be procured of any druggist, and when properly applied is a very efficient means of exterminating many kinds of beetles, worms, etc., from plants. Hand-picking of these bugs is sometimes resorted to, but it is a slow and tedious process.

**Rot.** — The rot is sometimes very damaging to grapes. Like mildew, it seems to be caused by a parasitic fungus, and warmth and moisture combined are essential to its development. It has been found that all varieties of grapes are liable to its attacks at all stages of the growth and maturity of the fruit; some varieties, however, appear to resist the attacks better than others. It has been found by experiment in covering the bushes when small with thin paper bags or mosquito netting and keeping them on until the close of the season, that this difficulty is prevented, which proves that the infection takes place by way of the

atmosphere. A board covering twenty or twenty-four inches wide is also said to be very effectual as a preventive.

**Web Worm.**—This worm is a very destructive caterpillar which attacks many kinds of fruit trees as well as other trees. The worms are small, light-yellow, with a black head and feet, a broad, dark-colored stripe on the back and another stripe beneath which is thickly covered with white hair. The eggs are laid on the under side of the leaf near the end of the twigs and branches. These are soon hatched, and the larvae commence eating the tender portions of the leaves, leaving only the skeleton, while they are always very active spinning their webs, which they do by weaving from one leaf to another, thus attaching three or four leaves together as a framework for the web. They appear in May and may be seen even in October, and sometimes leave trees looking brown and dead as though they had been burnt by fire. For exterminating these pests, the same methods are recommended as for caterpillars (which see).

**Woolly Aphis** (*Aphis lanigera*), sometimes called the American Blight, is a minute, white, downy insect that makes its appearance in the branches, — usually in the crotches and crevices, — and resembles mildew. These lice increase with great rapidity, and if not interfered with, will be likely to produce a diseased condition of the whole tree. They are, however, very easily destroyed by applying a wash of strong soap-suds, lye made of wood ashes, or whitewash made of unslacked lime with a little sulphur added. A wash of a half pint of kerosene oil mixed with a gallon of soap-suds is also an excellent remedy; also a wash of half an ounce of carbolic acid and a half pint of water will prove effectual.

**Yellows.** — No disease has proved so destructive to the peach as the yellows. It is characterized by a yellow appearance of the leaves, the production of very slender, wiry shoots a few inches in length upon the branches, the premature ripening of the fruit, a discoloration of the flesh, and spots of purplish-red externally. The disease spreads without actual contact, and frequently destroys large orchards. It may be communicated by contact of the roots, by pollen from the flowers of diseased trees, and by using a pruning knife upon healthy trees that has been employed in pruning diseased ones. The yellows has generally been regarded as incurable. Some of the most recent experiments, however, seem to indicate a remedy in a copious application of potash, or of some of its compounds, as promising a prevention, if not a positive cure, — muriate of potash having been used for this purpose. This remedy is based upon the theory that the vessels of the diseased tree are surcharged with starch, which the potash dissolves and dissipates.

Dr. Goessmann, of the Massachusetts Agricultural College, found on examining a peach orchard, that the trees which grew upon the top of a knoll were much diseased, while those on low and richer ground, and which had made a more vigorous growth, were exempt from it. Also, that in analyzing the fruit and branches of both healthy and diseased trees, the greatest difference in the fruit was, that the diseased specimens contained nearly twice as much lime as the healthy ones, and more phosphoric acid. In the branches analyzed, the diseased portions also contained the most lime, but much less potash. Other analyses showed an accumulation of starch in the diseased trees.

The experiment was made of treating the affected trees with three or four pounds of muriate of potash, together with the usual quantity of a phosphatic fertilizer, for each tree, and the diseased branches were cut back once or twice to the healthy wood. The new growth of branches soon regained a green color, and the trees were shortly in a vigorous condition. Subsequent examinations made by Professor Penhallow showed that healthy wood had but little stored starch, while the diseased wood showed the invariable presence of large quantities of starch, and also an abundance of fungous growth, which first appears on the surface. The fungus is found on trees which, once diseased, have been restored by the treatment

mentioned, which induced Dr. Goessmann to suspect that the fungus might be the effect and not the cause of the disease. In applying the muriate of potash to a tree six or eight years old, it should be spread over a circle sixteen feet in diameter, but kept away from the foot of the trunk. He prefers applying the phosphate in the form of dissolved bone-black.

Dr. Goessmann also states that sulphate of potash will not answer the purpose as a substitute in this disease, but muriate of potash should be used, and that it might be applied in a mixture of salt and ashes. Professors Caldwell and Burrill are of the opinion that the yellows in peach trees are caused by bacteria, also that it is the same growth that produces blight in pear trees, and the treatment of severe pruning or cutting away of the diseased branches is to be recommended, the same as for pear blight. We would recommend to all fruit growers in whose orchard the yellows makes its appearance, or as a preventive of it, a test of Dr. Goessmann's experiment. When the disease has progressed so far that a renewal of vigor is impossible, the tree should be cut down and immediately burned, both root and branch, if possible, and no tree be set in the place occupied by the diseased one, at least, for several years.

**Protecting Trees from Mice.**—Mice often prove very destructive to fruit trees, especially young trees, since they gnaw the bark from the stem near the roots, sometimes entirely girdling them. We have known of a large number of fine orchards being ruined by this means. They usually work under the snow, making their nests in the grass and rubbish that may be collected around the base of the trunk, especially if the trees stand in turf ground. Sometimes they go from tree to tree on the top of the crust formed by the freezing of the rain upon the top of the snow. Heaping up coal ashes or soil eight or twelve inches high around the trunks of the trees, or packing the snow hard around the trees, will sometimes prove effectual. Another very good plan is to make a mound of compact manure a foot or more high around the trunks late in autumn. This should be packed very closely around the trunk in order to secure the desired result. Straw, hay, or anything that would serve as material from which mice could make their nests should be carefully avoided. Soon after the snow is gone. the manure may be spread under the trees, and thus be made to serve a double purpose of protection in winter and a fertilizer in summer. Pieces of old tin fastened securely around the trees will also prove a complete protection; they should, however, be pushed down into the soil an inch or two to prevent the mice from crawling underneath.

**Rabbits** are also apt to injure fruit trees, in the same manner as mice, except more extensively. Encasing the trunks in old tin, or tarred pasteboard, serves as a good protection. Other plans highly recommended are to rub the bark of the trees with fresh blood or liver, or to kill a rabbit and to rub his flesh and blood over the trunks of the trees. This should be repeated two or three times during the winter. Sulphur mixed rather thick with refuse lard, and a half teacupful of kerosene added to each quart of the mixture. makes a good application for the trunks of the trees, one thorough application answering for a year or more. A mixture of fresh lime (first slacking the lime in water), flour, and soft soap is also highly recommended by those who have used it.

**Sheep and Cattle** often injure fruit trees, the former by gnawing the bark and the latter by browsing off the tender shoots, and rubbing against the trunks, thus loosening the roots and breaking the stems and lower branches. Rubbing the trunks of the trees with liver will prove effectual in preventing sheep and lambs from gnawing the bark. Fencing around each tree will also serve as a protection, but it must either be made very close or be so far from the trunks that the prematurely ripened fruit will fall within the enclosure, and thus one of the great benefits of keeping sheep in orchards (that of eating this fruit and thus destroying the larvæ they contain) will be lost. Cattle do no possible good in an orchard, but much injury, and should never be allowed there.

**Diseases and Enemies of Small Fruits.**—Some of the diseases and enemies of the larger fruits are also known to attack the small fruits, but the majority are peculiar to certain species of vegetable growths. We accordingly, for the sake of convenience, give in this connection the treatment for the diseases and enemies of such small fruits as the strawberry, blackberry, raspberry, currant, gooseberry, etc., as recommended by Professor A. S. Fuller, an able authority on this subject.

**The Strawberry.**—"Among the insect enemies of the strawberry the common White Grub is probably one of the most destructive. It is the larva of the May-beetle, June-bug, or Dor-bug, being known by all those names in different parts of the country. There are over fifty distinct species of May-beetles found in this country north of Mexico, but the one here referred to is our most common brown May-beetle, *Lachnosterna fusca* of Fröhlich. These beetles frequent meadows, pastures, and uncultivated fields, for the purpose of depositing their eggs in places where their young will be sure of plenty of food, and not likely to be disturbed. The young grubs as soon as hatched commence feeding upon the roots of various plants, those of the strawberry and different kinds of grasses being preferred to the weeds. These grubs live three years before passing through the pupa state and coming forth as beetles. During these three years of constant work upon the roots of plants they may do much damage to whatever kind they may attack. Their injury to strawberry plantations results mainly from bad management and the failure of the grower to use preventive measures.

Good old pasture and meadow lands are frequently selected for strawberry plantations, and sod is turned over, and as soon as sufficiently rotted, the plants are set out. In the mean time the grubs that were already in the ground, and perhaps of various ages from a few weeks to a year or two, have been fasting, or making an occasional meal of the half-decayed grass roots. Finding fresh strawberry roots thrust before them, they commence a most vigorous attack upon such tender food. The planter is astonished to see his strawberries disappear, and wonders where all the grubs could have come from in so short a time. Now in regions where the White Grub abounds it is not safe to set out strawberries on freshly inverted sod; but the land should be cultivated at least two seasons in some crop requiring frequent hoeing and plowing, before using it for this purpose. Neither should the strawberry plantation remain or be continued on the same piece of land for more than two or three years, if what is called the matted or bed system of cultivation is pursued; because the parent beetle soon learns that these weedy, little-disturbed plantations, are a safe place for her to deposit her eggs.

To avoid injury to strawberry plantations by this insect, use land that has been occupied at least two years in some hoed crop, like corn, potatoes, or beans, and then set out a new one on fresh land as soon as the old ones begin to fail. As all the May-beetles are nocturnal in habit many may be taken by using tubs of water with a floating light in the center. A few hundred taken every evening during the first few weeks of summer will do something toward diminishing the number of the succeeding generations in a neighborhood, but the birds and domestic fowls are the strawberry grower's most efficient helpers in the way of destroying May-beetles and White Grubs. Among the various other kinds of insects injurious to the strawberry there is perhaps none more destructive than that known as the 'Strawberry Worm.' This pest is a small, slender, pale-green worm that attacks the leaves, eating large holes in them. When at all abundant it destroys the entire foliage, and of course prevents further growth of the plants. A few years ago this pest almost ruined the plants in my garden, and of late it has not been very abundant, although it has not entirely disappeared. This Strawberry Worm is the larva of a small black fly (*Emphytus maculatus*). Dusting the leaves with lime would probably check the increase of this insect. There is also

another worm that attacks the leaves of the strawberry, but this is a leaf-roller and the caterpillar of a small, handsome moth (*Anchylopera fragariæ*).

I have not observed it in my grounds, but it is quite abundant in the Western states, also in Canada, where it is occasionally very destructive. In addition to the above there is a small snout-beetle known as the Strawberry Crown-borer (*Tyloderma fragariæ*), that works in the crowns of the plants, destroying the embryo fruit and stalks and leaves. The remedy proposed is to plow up the strawberry plantations soon after gathering the fruit in the summer, and while the little grubs are still in the crown of the plants. Several other species of noxious insects might be added to the above list of those injuring the small fruits, but I think enough has already been named to show that the berry-growers do not find the business quite so profitable or free from annoyances as many persons seem to imagine."

**The Blackberry.**—Some thirteen years ago the cultivators of the blackberry in some sections noticed that the young growing canes in summer would occasionally curl, twist about, and often assume a singular, fasciated form, resulting in an entire check to their growth. The leaves on these infested shoots did not die and fall off, but merely curled up, sometimes assuming a deeper green than the healthy leaves on the same stalk. At the approach of winter, the infested leaves remained firmly attached to the diseased stems, and all through the cold weather, and far into the spring, these leaf-laden and diseased stems were a conspicuous object in many of the blackberry plantations of this State. If the infested shoots are examined in summer, thousands of minute insects of a pale yellow color and covered with a powdery exudation will be found sucking the juices of the succulent stems and leaves, causing the crimping, curling, and twisting of these parts as described.

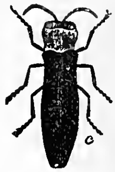
This parasite resembles somewhat an ordinary green-fly (*Aphis*) or plant-louse, but according to the observations of Professor Riley it belongs to the closely allied Flea-lice family (*Psyllidæ*), distinguished from the plant-lice by a different veining of the wings, and by the antennæ being knobbed at the tip, like those of the butterfly, the knob usually terminating in two bristles. These insects jump as briskly as a flea, from which characteristic they derive their scientific name. They have increased very rapidly during the past half dozen years or more, and unless fruit-growers make a more vigorous fight than they yet have done, they will soon get the mastery of most blackberry plantations. The only practical method yet discovered for checking the ravages of this insect, is, to cut off the ends of the infested canes and burn them. This operation should always be performed either in the morning, or during cool, wet weather, else many of the insects will escape, and at all times the severed shoots should be immediately dropped into bags and in them carried to the place where they are to be burned, and there emptied into the fire. If every one having blackberry bushes in their gardens would practice this method of destruction, this pest would soon cease to do much harm.

Several species of borers infest the blackberry: the most common one is the larva of a small, slender, red-necked beetle, the *Oberea perspicillata* of Haldeman. The small, legless grubs bore the pith of the canes, causing them to die prematurely, or so weakening them that they are broken down with the wind. As there are some fourteen or fifteen species of the *Oberea* now known, it may be that more than one species breed in the blackberry. Thus far, however, I am not aware that they have been very injurious, but it would be well to gather all infested canes and burn them with their contents. The blackberry is subject to the attacks of several species of gall-insects. A fuzzy, prickly gall on the twigs is produced by a four-winged fly (*Diastrophus cuscutæformis*). Another species of the same genus (*Diastrophus nebulosus*) produces a large pithy gall on the canes, but both of these gall-makers have very formidable parasitic enemies which keep them in check. There are also a few leaf-eating beetles, slugs, and caterpillars, that sometimes attack the blackberry, but they are seldom sufficiently numerous or injurious to attract much attention. The larger

species are readily destroyed by hand-gathering. and the smaller ones can usually be driven off by dusting the plants with lime.

The most formidable enemy, however, of both the blackberry and raspberry is what is called the Orange-rust (*Uredo ruborum*): It is perhaps more abundant on the Black-cap raspberry (*Rubus occidentalis*) than on the ordinary varieties of the blackberry; still it is sufficiently abundant and destructive to all to attract the attention of horticulturists throughout the country. I do not know of any remedy except to stamp out the disease by rooting up every affected plant and burning it. It may be that applications of lime, salt, or some similar substance would check the disease, and while these may be safely tried as preventive measures, the destroying of all infested plants should not be omitted.

**The Raspberry.**—As the raspberry is closely allied to the blackberry and belongs to the same genus, the diseases and insects infesting both do not materially differ. Some few species of insects seem to prefer the raspberry, notably among which is what is called the Red-necked Buprestis (*Agrillus ruficollis*), a small beetle that seems to be particularly fond of the red and black-cap varieties, but will occasionally attack the blackberry. The larva bores the canes in summer, causing large excrescences or galls, checking the flow of sap, and causing the death of the cane. This insect seems to be far more plentiful in the western than eastern States; but it is widely distributed, and every cultivator of the raspberry may as well be on the lookout for it, and gather and burn all canes upon which galls of any kind are found.



AGRILUS RUFICOLLIS.

The snowy Tree-cricket (*Œcanthus niveus*) is another insect that appears to prefer the canes of the raspberry as a nidus for its eggs to the twigs of other shrubs or trees. It will, however, use the grape, willow, peach, and other kinds, if raspberries are not convenient. The long, slender eggs are deposited in a close compact row, an inch or more in length, each egg placed at a slight angle, and deep enough to reach the pith of the cane or twig in which it is set. This weakens the canes, and they are often broken off by the wind. This injury does not amount to much, but the perfect insect has a very bad habit of cutting off leaves in summer; and sometimes extends its mischievous work to the grape-vine, trimming off both leaves and fruit, working at night when perfectly safe from observation or molestation. One of my correspondents in Texas wrote me, a few years ago, that one of these pests would completely defoliate a young grape-vine in a single night, and he was a long time in discerning the successful nocturnal pruner, and when discovered he was at a loss how to circumvent it. Destroying the eggs is the only way I know of fighting this insect.

**The Currant and Gooseberry.**—After two or three centuries of almost entire exemption from noxious insects, it is no wonder that our people came to look upon the currant as a fruit for everybody, and one that could be raised in almost any corner of the garden without care or cultivation; but all at once and without warning, not only did its ancient enemy from the other side of the Atlantic appear in this country and commence its destructive work, but several native species of insects joined in making havoc with our currant and gooseberry bushes. First, the imported currant worm (*Nematus ventricosus*) made its appearance about Rochester, New York, in 1857; then it was soon discovered that we had a gooseberry span-worm (*Eufitchia riberaria*), the former being the larva of a four-winged fly, and the latter the caterpillar of a small moth. These two species

IMPORTED CURRANT WORM:—*a, a, a*, larva in different positions; *b*, side of a middle-joint enlarged, showing arrangement of tubercles (after Riley).

spread with great rapidity, and seemed for a while to defy all the usual insecticides and other methods of destruction. Then the late Mr. Walsh of Illinois discovered a native saw-fly, the *Pristiphora grossulariæ*, which was also double-brooded like its European congener, and fed upon the currant and gooseberry, rather preferring the latter.

With these three insects; with a borer or two that perforates the stems of the plants, and several species of plant-lice infesting leaves, roots, and green shoots, the cultivators of the currant and gooseberry have had all they could do to keep their plants alive, and obtain even a moderate crop of fruit. For the different species feeding on the leaves nothing has been discovered better in the way of destroying them than powdered white hellebore. A few dustings with this, at the proper time, will usually destroy these pests Hand-gathering may also be practiced, as well as frequent cultivating the ground among the bushes, in order to unearth the worms that have passed it to undergo their transformation.

The common currant stalk-borer (*Ægeria tipuliformis*) is well known to all growers of this fruit; at least the larva or grub is, which may be found in the canes during the fall and winter months, and during this time all infested shoots should be cut and burned with their contents. There are also one or two other species of currant-borers, but as they are all found in the stems during winter, one method of destroying will answer for all.

The diseases of currants and gooseberries are mainly climatic, consequently difficult to prevent or cure. Mildew on the gooseberry is the one most dreaded, and the better way is to avoid it by cultivating only those varieties that are adapted to your soil and climate, and the native ones are preferable to the foreign on this account. In cool, moist soils, or with a liberal amount of mulch and thinning out of the heads of the plants, the European varieties may be occasionally made to succeed moderately well."

**Large Fruit Farms.**—The following account of two large and thrifty fruit orchards in Pennsylvania may serve to show what can be accomplished by well-directed and judicious management, combined with a thorough knowledge of the business of fruit-growing:

"The largest, finest, and most productive fruit farm in Erie County is that of Mr. A Battles. Although this farm is only about three miles from the beautiful borough of Girard, I venture to say that many persons in this township. who are admirers of rural beauty and choice fruit, have never seen it. Of the 10,000 or 12,000 bearing fruit trees on these two hundred acres, 6,000 are apple trees; 1,500 pear trees; 2,500 peach trees; and 500 quince trees; all of choice varieties. When I visited the farm, in June, the prospect for a fine yield of apples, pears, and peaches, was flattering; but the severe and protracted drouth has caused much of the fruit to wither and fall. Mr. B. has six acres of grapes, mostly Concords, although he grows Catawbas, Isabellas, and other choice kinds to accommodate his customers. As his farm is bounded on the west by a dense forest, his fruits have never been injured by that destructive insect the rosebug.

Fourteen acres of the farm are planted to strawberries, raspberries, and blackberries. Mr. B. prefers the Crescent Seedling to any other strawberry for the table or market. Its yield is wonderful. It is larger than the Wilson, and has a finer color and flavor.

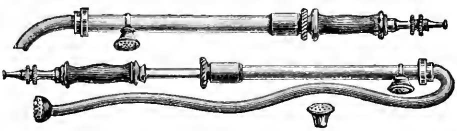
Although the extremely dry weather has probably reduced the yield one-half, I present the figures below as a result of Mr. B.'s strawberry season. Whole amount gathered from one and one-fourth acres, 275 bushels, mostly Wilsons. Whole amount for Crescent Seedlings gathered from one-tenth of an acre, 47½ bushels, or at the rate of 475 bushels per acre. Amount of sales from one and one-fourth acre, $482.51, after deducting the expense of marketing. Paid for picking the berries, $51.21. Profit from one and one-fourth acres of land, $431.30; not a bad result, considering the unfavorable season.

I noticed on the farm some splendid specimens of Lancashire swine. They run in the orchard, and become fat easily and in a short time, by feeding on the grass, and on the diseased and immature fruit that drops from the trees."

Mr. Solon Robinson, for many years a well known agricultural writer, recently traveled 1,000 miles to see a famous Pennsylvania orchard on the Juniata river, in Juniata county, 144 miles from Philadelphia, near a little station called Thompsontown. "There," says Mr. Robinson, "if the traveler going west on the Pennsylvania railway will look out south and up the steep hillside, he will see the main part of the orchard of 15,000 peach trees, 10,000 quince trees, and 9,000 Siberian crab-apple trees. And, if he could stop, and walk and ride through the orchard, as I did to-day, and find one dead or diseased tree, he will find more than I could; although I was told by Mr. Taylor, the foreman, that he did lose one tree in the section where we were. 'And how many trees are there in this section?' 'Six thousand.' If a like result can be found anywhere else on earth, I should like to be informed, that I might make another pilgrimage of 1,000 miles to see it, as I have to see this, the most healthy, thrifty, most promising young orchard I have ever seen in all my extensive journeys through the United States and Canada. Yet most of the land is unfit for any other cultivation, and a considerable portion of the ground has never been plowed, because so steep and so full of stones and roots. The orchard is owned by H. Bradford, of Connecticut. A few years ago the tract containing 440 acres came into Mr. Bradford's hands, upon the false representation that it contained valuable veins of iron ore. He bought it unseen. When seen, it was found to yield no workable ore, and only a small tract of farm land, with a few common farm buildings. The question then was, "What shall I do with it?" That question has been answered in the splendid orchard on the ground.

**Sprinklers and Atomizers in Fruit Culture.**—There are many kinds of implements employed in sprinkling trees and plants with various poisons, or other solutions for the purpose of destroying the insects that, by their depredations, are a great injury to crops. Prof. C. V. Riley says of such machines: "Most of the machines used for throwing liquid on a large scale, whether patented or not, are modifications of one and the same idea and principle, viz.: a barrel or other vessel to contain the liquid, a vehicle to carry it, a force-pump firmly secured to the top of the barrel, and a distributing nozzle, or several of them, connected with the discharge-pipe. The differences they exhibit are found principally in the nature of the distributors, the most successful ones being those which least clog, since it is almost impossible to get such pure water that there will not be some clogging material, even where strainers are used."

FOUNTAIN PUMP IN USE.



FOUNTAIN PUMP.

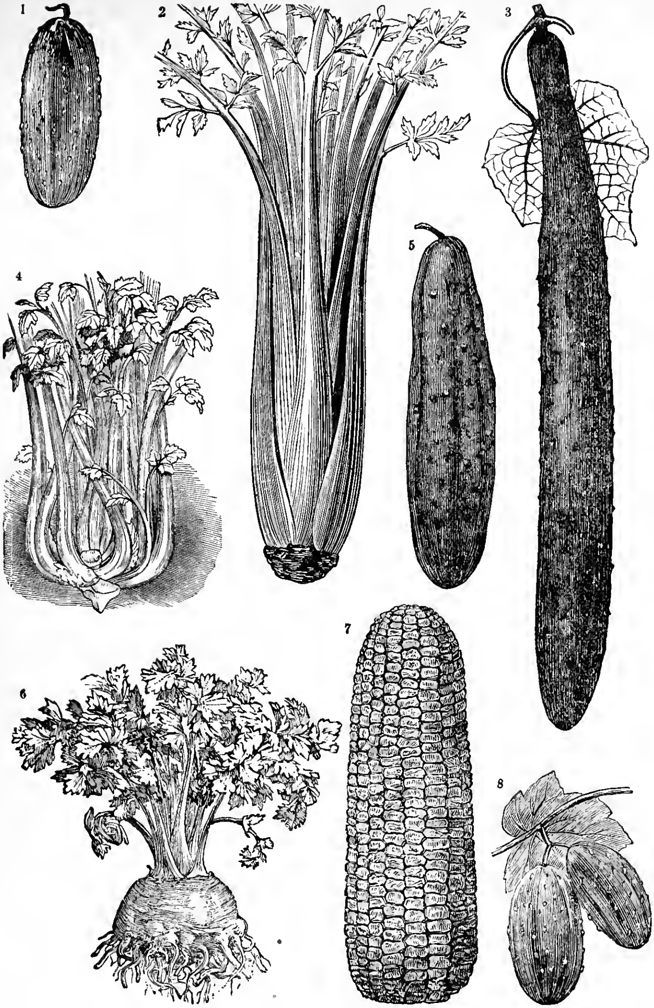
The accompanying cuts represent the portable fountain pump or sprinkler manufactured by Mr. J. A. Whitman, of Providence, R. I., showing the manner in which such machines may be used. A western farmer and fruit-grower says: "We have proved by two or three years' experiments in northern Illinois and southern Wisconsin, that a solution of arsenic or Paris green sprinkled on the foliage of fruit trees will as effectually destroy the canker worm as Paris green does the potato beetle. For want of a proper instrument to apply the solution, our experiments for some time were limited to a small scale.

With the portable fountain pump and sprinkler, a man with a team and a driver can easily sprinkle from 300 to 500 orchard trees in a day; the sprinkler throws about forty jets

at once through holes about the size of a common needle; the water can be easily thrown with such force as to go through among the foliage of the tree, thoroughly wetting, or may be thrown over the tree and fall like a gentle shower or spray; in either case but very little fluid need be wasted. As this instrument is held and worked wholly by the hands, it may be used while the operator is either standing or sitting. The fluid is drawn from the barrel or vessel containing it through a small rubber hose. The poisoned water will not injure the fruit, as it is washed away by the first shower."

It is said that two ounces of strong ammonia, mixed with a pail of water, and applied to the foliage of the trees once or twice a week, will destroy the codling moth, canker worm, and other similar insects.

Such implements are a great convenience in many ways, and may be used for various other purposes, such as watering gardens and lawns, extinguishing fires, washing windows and carriages, bringing down a swarm of bees by spraying them with water when they attempt to leave the premises, etc. A slight expense in procuring a good spraying machine of some kind will repay the farmer or fruit-grower a thousand times over, in the saving of crops from the ravages of insects, as well as that of strength and time spent in endeavoring to keep them in check by more laborious and difficult methods.



1. Improved Early White-Spined Cucumber.
2. Dreer's Large White Solid Celery.
3. English Prize Cucumber.
4. Boston Market Dwarf Celery.
5. Tailby's Hybrid Cucumber.
6. Celeriac, or Turnip-Rooted Celery.
7. Evergreen Sweet Corn.
8. Early Russian Cucumber.

# PART V.

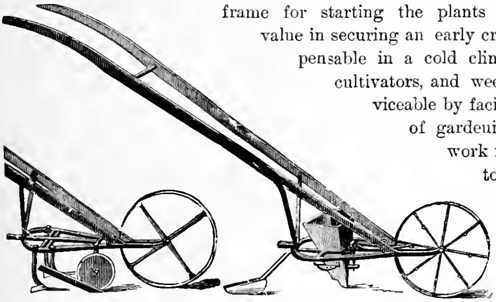
# GARDENING.

**FARM GARDENS.**—As a general rule, farmers do not appreciate as they ought the value of a good garden, not only as furnishing the means of a choice variety of fresh fruits and vegetables for the family table, but the sanitary effect of such food, as well as the economy of raising it rather than purchasing. Farmers frequently purchase radishes, onions, lettuce, beets, early turnips, strawberries, etc., that might better be raised at home, since these things could be cultivated in abundance with but little labor and expense, and could then be obtained fresh when wanted for use, which is not always the case when depending upon a market. But there are many families among farmers that would be deprived of the variety of vegetables and fruits commonly found in the markets unless they raised them themselves, as their purchase would involve an expense which they did not feel able to meet; consequently there is in far too many families needless deprivation of many of the nutritious, healthful, and highly relished articles of diet, simply from thoughtlessness, careless indifference, or the dread of the little extra attention and labor that would be necessary in the care of a good garden. We have known many hardworking farmers who would expend an unnecessary amount of money and labor, toiling early and late upon some of their field crops with the greatest interest, but who considered it a petty nuisance to be obliged to spend half an hour each day in the care of a garden, which would probably repay them a hundred per cent. more for the real labor and time expended than the former. As a rule, the list of vegetables and fruits found in the farmer's garden is confined to potatoes, turnips, beets, peas, cucumbers, beans, lettuce, cabbages, currants, and apples. The long list beyond this, that is found in almost every village market, and frequently upon the tables of day laborers and mechanics in large villages and cities, is wanting. There is no valid excuse for this dearth of wholesome vegetables and fruits upon the farmer's table, where the materials for manufacturing them—the soil, manure, sunshine, rain, and dew—are ever at hand in such abundance. The farmer who goes without these things does so either from careless indifference or sheer shiftlessness, while he is not only deprived of a wholesome and pleasing variety on his table, but the most economic means of maintaining his own health and that of his family.

As a matter of economy, simply, every farmer should have a good garden, for when properly located, drained, fertilized, and cultivated, it will bring larger returns for the outlay and save more money for its cost, by way of furnishing supplies for the family table, than can be obtained from any of the farm crops, while it will contribute largely to the comfort and health of the family. But little extra care and attention would be required to produce a good supply of a variety of vegetables, while strawberries, raspberries, gooseberries, cherries, plums, peaches, pears, grapes, etc., might be grown in a garden in abundance for family use with even less outlay of time and labor than that required for the cultivation of the vegetables, while each would repay many times over for the trouble and expense of growing. The sanitary influence of good fruits as a part of daily diet has already been noticed in connection with fruit culture, while that of nice, fresh vegetables is scarcely less so. The most

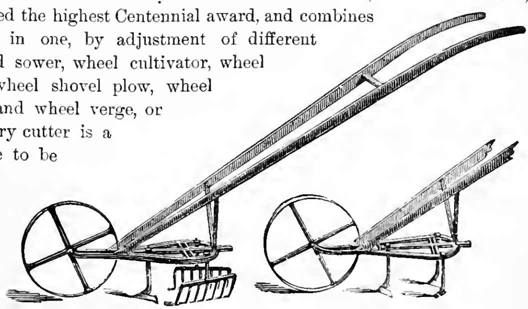
healthy families, as a rule, are the largest consumers of fruit and vegetables. The sub-acid or acid of fruits regulates the bile and the digestive apparatus generally, preventing fevers, indigestion, and other ills of the system. The cultivation of a good garden, with a large variety of vegetables and fruits that are adapted to the climate, also, has an important bearing upon the success of field husbandry, since it awakens an interest in agriculture generally, cultivates habits of observation, stimulates enquiry, leads to study and reading, expands the mind, and makes farming more a business of the mind than of muscle; hence it has a tendency to elevate the farmer and his occupation, making farming more of a successful business enterprise, and less of an unskillful and unremunerative drudgery.

**Garden Implements.** — In the proper management of the garden, there are many aids in the form of implements which may be regarded as indispensable to thorough and efficient cultivation These comprise the spade, fork, shovel, rake, hoe, trowel, garden line and reel, watering pot, and wheelbarrow, while a hotbed or cold frame for starting the plants for early planting is of great value in securing an early crop of vegetables; in fact, indispensable in a cold climate. Many of the wheel hoes, cultivators, and weeders now in use are very serviceable by facilitating and lessening the labor of gardeuing, as well as performing the work iu a more thorough and satisfactory manner than could be done by hand. In the use of such implements, the width of the spaces between the rows and drills must not only vary according to the nature of the crops cultivated, but to suit the width of the weeder and cultivator in some one of its adjustable forms. The accompanying cuts represent the different combinations of the well-known and valuable garden implement invented by Mr. Wm. G. Comstock, for many years an extensive seed grower, and manufactured by the Comstock Brothers, of East Hartford, Conn. This machine received the highest Centennial award, and combines the following implements in one, by adjustment of different attachments: A wheel seed sower, wheel cultivator, wheel rake, wheel scuffle hoe, wheel shovel plow, wheel strawberry-runner cutter, and wheel verge, or turf cutter. The strawberry cutter is a sharp steel wheel and knife to be fixed to the cultivator and weeder for removing strawberry runners, cutting the runners and cultivating between the rows at the same time. The Seed Sower is an attachment that may be combined with the cultivator and weeder, and can be attached in five minutes. It sows beet, parsnip, and other seeds difficult to sow, or that can be sown with any seed sower, with the



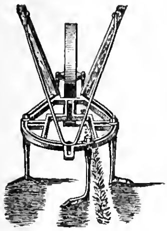
Cultivator with Strawberry Cutter. Seed Sower.

COMSTOCK'S SEED SOWER AND CULTIVATOR COMBINED.



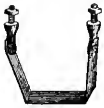
AS A WEEDER. AS A CULTIVATOR.

greatest regularity, without waste or clogging, is sure not to clog with rough or imperfectly cleaned seeds, and stops sowing the instant the machine is at rest. The Verge Cutter is a steel tool, to be fixed to the cultivator, for cutting and paring the turf edges of walks, and borders in lawns and gardens. The Scuffle Hoe is set in the frame diagonally, with the standards in the outside slots on both sides, and may be used to scrape and clean the surface of walks and alleys. This, and the Verge Cutter, are useful accompaniments to a lawn mower. The Mole Plow runs under



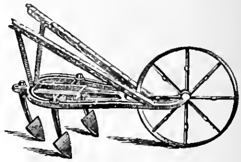
Strawberry Runner Cutter.

Verge or Turf Cutter.



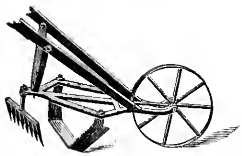
Scuffle Hoe.

Mole Plow.



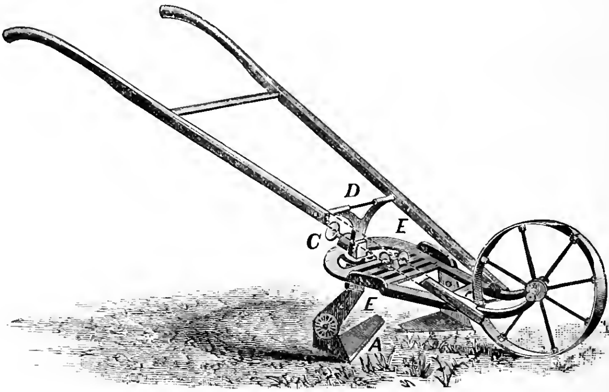
As a Shovel Plow.

ground and loosens heavy soils, to let in air, rain, and fertilizers to the roots, without disturbing the plants — similar to a subsoil plow. The changes for each kind of work can be made in a few minutes, and every implement of the combined machine works as well as if made specially for the purpose. We are familiar with the working of this implement, and are confident that when used alone or with any of its adjustments, it will give entire satisfaction.



TURF CUTTER, ETC.

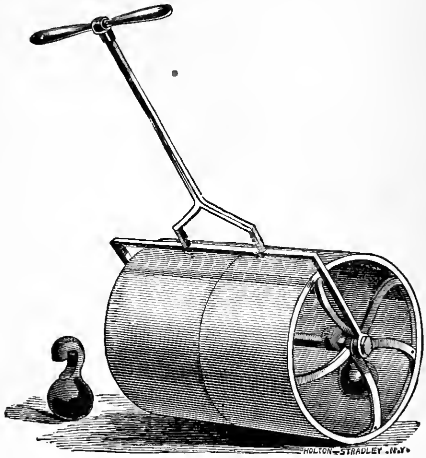
The following cut represents an implement which combines a scuffle hoe, turf cutter, and edging knife in one. This will cut turf of uniform width and thickness, and may be used for cutting the edges of walks and borders, and for scraping and cleaning alleys, etc. It is also used very effectually as a cultivator.




RUHLMANN'S WHEEL HOE.

NOTE.—*A*, the cast steel knife, corrugated to be set at any angle desired; *C*, thumb-screw to raise or lower the handles; *D*, ridged brace for supporting and regulating handles; *E*, thumb-screw for regulating blade shanks.—*New York Plow Co.*

A garden roller will also be found useful in pressing the soil upon the seed after planting, thus causing it to germinate more quickly than it would if the soil were left loose. For market gardening, a seed sower would be essential. A garden marker is also a great convenience for marking the place for transplanting celery, cabbages, lettuce, etc. Different kinds of markers are in use, but one may be easily constructed by using a good-sized wheel, to which handles may be attached like a wheelbarrow; also a side marker to denote the rows, the tire of the wheel being provided with movable pegs, which can be adjusted at such distances as are required for the plants to be set. After properly preparing the land, the rows may be marked and also the place for setting the plants by wheeling this implement over the ground, the rows and place for setting being thus marked uniformly.



GARDEN ROLLER.

**Hotbeds and Cold Frames.**—There are many kinds of plants commonly cultivated in gardens, which it is desirable to start earlier than could be done in the open air, in order to secure early vegetables in the Northern and Western States, while there are also several varieties that will attain a more rapid growth and be more productive if properly transplanted, than if allowed to grow where the seed is sown. Farmers, therefore, frequently purchase some kinds of plants ready for setting, or start them in window boxes. But the latter method is very inconvenient, and the better plan is to make a hotbed or cold frame, and start the plants that are desired for early maturity, such as tomatoes, lettuce, cucumbers, squashes, cabbages, cauliflower, etc., or such plants as are needed in an ordinary garden, at little or no expense in money, and very little time or care in labor, and much sooner than if the seed were sown in the open ground.

This should be located with a southern or southeastern exposure, and in a sheltered spot, and the land be dry and level. Such frames may be of any size, according to the size of the garden, and the number of plants required. A cold frame consists of an enclosed bed of soil covered with glass. In making such a frame, four posts should be set in the ground at the corners to give support to the planks that form the sides, to which they should be nailed. The back of the frame should be about a foot high, and the front four or five inches less. For ordinary farm use, a frame six or eight feet long, and three or four feet wide, would be sufficiently large. The end pieces should be made to slope from the back to the front, and fastened evenly on so that when the sash is on there will be no cracks left for the cold wind to blow in, or the warm air to escape. The top should be made of glass set in sash, the size of the glass usually being 8 by 10 inches. Old windows will also answer every purpose for covering.

Mr. William D. Philbrick gives his method of making a hotbed as follows: "The hotbed, as used by market-gardeners, is a much more simple affair than is usually described in the books. We build a fence, facing southeast or south, using posts nine feet long, three

feet in the ground, six feet above; and set them six feet apart, leaning back eighteen inches at the top, so that the mats when leaning up against them are not likely to be blown down. Planks 2 by 12 inches are set in the fall, before the ground freezes, so as to make a frame six feet wide, outside measure, two feet from the fence, and carefully adjusted so that when the sashes are placed on them they will pitch five inches. The space between the plank is then covered with litter, to keep out the frost, and the bed can be used at any time in the winter. When it is needed for use, the loam is thrown out, and fresh horse manure put in to the depth of six to twelve inches according to the season of the year and the crop to be raised; the loam is then thrown back on the manure to the depth of six or eight inches, and covered with sash and mats, and after a few days the bed will generally be in order for planting."

The soil within the frame should be deeply spaded, — from one two feet, according to the season and the amount of heat required, — also finely pulverized. When much heat is required for a hotbed, the soil is taken out to the depth of several inches, and a quantity of fresh horse manure is put in mixed with a few leaves, and from six to ten inches of rich soil spread evenly over the manure. The frame is then covered with the sashes, and after standing a few days to allow it to ferment, and the rank heat and steam to pass off, the seed may be sown. Where the ground is well drained, it is thought by many to be a better plan to dig out a space from one to two feet deep the size of the frame, according to the amount of heat required, the season, etc., then pack the manure in firmly and evenly before covering with the soil

**Care of Hotbeds, etc.** — Before sowing the seed, the surface soil should be worked so as to render it more moist and also to pulverize it. When the soil is cold and damp, the sash should be kept on for a few days before sowing in order that it may become warm. The bed should be watered a little every morning and the soil kept damp, but not so wet as to cause the seeds to rot. During warm days the sash should be raised a little to admit the air; it should, however, be kept closed during cold nights. Sometimes during very cold days, and especially nights, mats or old pieces of carpeting will be required to cover the sash, to prevent the freezing or chilling of the plants. If the plants grow too rapidly, and too slender, it shows that the air is too warm in the frame, and more air from outside should be admitted It should be remembered that the slower growing plants will be more hardy, and that the object of the frame is not only to start the plants, but to preserve them from freezing.

A little experience will enable the person having charge of a hotbed to determine the amount of heat and air required for a healthy growth. As the season gets warmer it will be necessary to shade the glass during the hottest part of the day. Before transplanting, the plants should be gradually hardened by first half removing the sash for a few days, and afterwards removing it altogether. This may be done when the temperature is no lower than 30°, but they may be opened more or less, when below this. Some air should be given when the temperature is as low as 10°. If there should be a considerable fall of snow, it is always best to remove it from the sashes to prevent the plants from becoming too warm, and start into an unhealthy growth But it is always safe to be prepared for a sudden change of temperature to severe cold, after a succession of mild days. In such cases, shutters, old carpets or mats, straw, marsh hay, or other litter should be in readiness to place over the sashes to protect the plants from freezing. When the plants have been well hardened, and the temperature of the season and the soil are suitable, they should be carefully removed and transplanted.

**Soil and its Preparation.** — The quality of the soil and its preparation has a great influence in determining the results attained in gardening. With all the other provisions made for easy and efficient cultivation, these must not be overlooked. It is true that all vegetables do not require the same kind of soil, but for general purposes, a deep, black loam,

well drained by a fine, sandy subsoil, is the best. A light soil that requires no underdraining may be easily worked, but requires more frequent applications of manure, which may be best applied in the form of compost, made of one-half loam and half manure. Cabbages, celery, cauliflowers, and such plants thrive in a rather stiff soil, while radishes, beets, lettuce, and many of the early garden crops seem to do best in a warm, sandy loam. The soil for a garden should be rich; a dry, loose, gravely soil is unfit for a garden. When the soil is naturally light and thin, the mixing of some clay will be an advantage. The best method of applying it, however, is to compost it first with manure, the clay acting as an absorbent in the compost heap. The reverse is also true, viz.: when soils are too heavy they may be improved by mixing with sand. Lands that are too wet should be thoroughly underdrained.

The soil for a garden should be finely pulverized and made friable in order to secure a speedy germination of the seeds, while, where kept so, it is one of the most favorable conditions for the destruction or prevention of weeds. The manure applied should also be well pulverized and thoroughly mixed with the soil. For all the practical purposes of gardening, well composted barn-yard manure seems to be the best material for fertilizing, although many of the concentrated manures now manufactured are valuable and convenient, especially where a succession of crops is desired. Wood ashes, bone dust, superphosphate, guano, and lime are also excellent fertilizers when the soil requires them. The site of a garden, or rather its exposure, has much to do with the early maturity of the crops, an exposure to the morning sun being desirable.

**Seed.** — The best seeds should always be secured for gardens, not only the best varieties, but fresh seed that has not lost its vitality by being kept too long. Seed frequently fails to germinate from being sown at an improper season, or when the soil is not in a suitable condition. Other reasons for failure may be attributed to insects in the soil that devour the germ either before or soon after it appears above the ground, — unfavorable conditions of the soil, that may cause the seed to rot before vegetating, or the germ to dry up and die, etc., — all of which conditions and possibilities should be taken into account by the gardener, and be obviated as far as possible. For a more extended treatment of this subject, see GOOD SEED (VOL. I, page 512).

**Transplanting.**—Plants are frequently lost after being transplanted from the seed bed, simply from the work not being done in a proper manner. If taken up at the right time, and with care, and without disturbing the roots, and the ground for receiving them be suitably prepared, there is no reason why plants that are transplanted should not live and thrive well. A misty day with a wet soil is the best time for resetting, the mist settling upon the leaves, freshening the plants, and giving them a good start before being exposed to the sun. When such a day does not appear, after a shower just at night, is also a good time. The soil is then wet, and the dew and shade afforded by the night will give the plants vigor and strength to better bear the sunlight. If one or two cloudy days should follow transplanting, so much the better. When it is necessary to transplant during dry weather, make a suitable hole or excavation in the ground for the roots, and fill it with water; as soon as the water soaks out, leaving the ground in a moist condition, place the roots in the opening made for them, and press the earth firmly around, it being made to come to the first leaves. If the weather continues dry, remove the soil slightly from around the plant with a hoe, leaving it in the form of a basin around the stem. Pour the water into this basin (not upon the plant to drown it), and in an hour or so after it has soaked into the soil, draw the earth over the surface and cover as before. Plants treated in this manner, even if set in a very dry time, will scarcely ever fail to live. All roots should have the place made to receive them suited to their form, and placed as nearly as possible in the same manner as before being removed,

always remembering to press the soil firmly around the roots, and to cover them well, or,—with most garden plants,—as deeply as the first leaves. The after-culture is to keep the garden free from weeds, and the soil in a friable condition by frequent stirring. When the insects are troublesome, remedies must of course be applied or resorted to for their extermination.

**Market Gardening.**—This consists of growing vegetables extensively, for the purpose of supplying the demand for such articles in the markets of large cities and towns. Mr. J. B. Moore, of Concord, Mass., well known as an extensive fruit-grower and market gardener says of market gardening: "It is a form of agriculture combined with horticulture, and to be carried on successfully must have, in addition to the original cost of the land, a considerable amount of capital invested in manure, glass, and structures, either in the form of forcing houses or hotbeds. And it requires more skill in the preparation of the soil, more skill in the selection and planting of the seed, more skill in the adaptation and application of manure to the different varieties of plants, and more skill and care in the preparation and marketing of the crops than is usually practiced in ordinary farming.

It is also a source of constant care to any one who carries on the business, and there exists a necessity of doing everything at the right time, no matter what the state of the weather may be, wet or dry. And there must be a constant watch kept for insects injurious to plants, so that they may be promptly exterminated, and before they have increased so as to render their destruction a matter of difficulty, or have done the garden much damage. And as compared with common farming it involves harder work, but is more profitable."

**Essentials in Market Gardening, Profits, etc.**—The requisites included in market gardening have been so admirably defined by Mr. William D. Philbrick of Mass., so well known as a skillful market gardener of extensive experience, that we give his opinions the preference in connection with this subject. He says: "The essential things for profitable market gardening are nearness to a good market, a good soil, and sufficient capital. A good gardener should have a natural tact for the business, which will include habits of industry, a keen, observing eye, and should have some years experience; for it is a trade that cannot be learned wholly from books and papers, but needs practical acquaintance with the many details of the work for success. Many of the failures in attempting this trade or business are due to want of capital, but perhaps more to want of the necessary experience, or of natural tact.

The distance from market will control, in a great measure, the nature of the crops that can be profitably grown. Within six miles of a large city, the manure wagon and market wagon can make two trips in a day, if needful; and this nearness gives a very great advantage where a large amount of manure must be applied to a small amount of land, and balances the greater amount of land, and higher taxes and rent, or interest, which encumber the garden near town. Many of the gardens near Boston are worth over one thousand dollars per acre. The amount of manure used on these gardens is from twenty to thirty cords per acre every year. It keeps a two-horse team going every day to draw the manure used on some grounds, of not over twelve acres, and the produce on some of the gardens will average one thousand dollars per acre per year, for the whole garden, for a term of five years. The market wagon upon such a garden makes daily trips to market, and at certain busy seasons three or four loads daily will be sent.

When the distance from market is more than seven, and less than fifteen miles, the nature of the business is changed. Land is cheaper, being worth from fifty to two hundred dollars per acre: the hauling of manure and of produce costs double or more what it does nearer market; and here it is that we find the gardeners (or farmers as they are more properly called) devoting their energies with greater profit to such vegetables as require less manure,

and are less bulky, such as early potatoes, beans, asparagus, strawberries, and other small and large fruits, squashes, late cabbages, turnips, and other roots. On these more remote gardens, the market wagon will make only three or four trips per week, in general, in summer, and two in winter. The value of the crops raised will naturally range from two hundred to five hundred dollars per acre. The amount of manure required for the good management of these farms will be from six to ten cords per acre.

The nature of the soil has much to do with a good garden. The best for general purposes is a deep black loam, well drained by a subsoil of fine sand; but it is desirable to have some variety of soil, as no one soil is adapted to produce all the vegetables in perfection. A rather stiff soil suits late cabbages, celery, and cauliflowers, while early lettuce, radishes, beets, and roots in general, as well as greens and most early crops, do best on a warm, sandy loam. If the soil is a dry, loose gravel, it is utterly unfit for any kind of gardening. Stiff clay and boggy lands, when well drained, often make excellent garden land, especially for late crops. The capital needed for gardening is larger than would be supposed by one unacquainted with the business. For gardens near market, five hundred dollars per acre is often profitably employed, invested in buildings, teams, tools, hotbeds, manure, etc.; and the force on such gardens is about one horse to every three acres of land, and in summer, one hand to every acre. On the more remote gardens a less capital and force are used, the capital ranging from one hundred to two hundred dollars per acre, and the force, one horse and one man for two to five acres.

The methods used by the market gardeners to make the most of their land are very ingenious, and deserve a more careful and extended study than can be here given; but it may be useful to notice some of the plans in use, by which they force our naturally sterile soil and fickle climate to produce two, three, and even four crops in a year, from the same land, and keep our markets supplied through our long winters with delicacies whose natural home is in the tropical zone. The crops grown upon the gardens within six miles of large cities are mostly spinach, kale, radishes, dandelions, beet-greens, beets, early cabbages, lettuce, onions, to be followed upon the same land by the late crops, which are melons, squashes, tomatoes, egg-plants, peppers, cauliflowers, celery, horse-radish, beets, carrots, parsnips, etc., The only crops which occupy the land for the whole year are rhubarb and dandelions; and some gardeners grow a crop of onion sets on the same land with their dandelions.

In the management of these various crops so as to meet a profitable sale, and also not to crowd and injure each other, the skill and experience of the gardener are shown. To accomplish his purposes many ingenious devices are used for forcing early crops, and for storing the late ones, so as to keep up an unfailing supply the year round. In general, only two crops are raised upon the same land in a season; but instances are not uncommon where three, and even four crops in a year are taken from one piece of land. Thus, winter spinach, sold in March, was followed by onion sets, melons, and celery, on the same land, all full crops; again winter spinach, sold in April, was followed by bush-beans, melons, and spinach again It would be idle to attempt such work as this without skillful use of glass and heavy manuring. The plants started under glass for field planting are lettuce, early cabbage, egg-plants, tomatoes, celery, melons, summer squashes; and some gardeners also start their beets and onions under glass, to be transplanted to the field.

The hotbed is invaluable for raising plants for planting out of doors; the ease with which the plants are aired and hardened off by removing the glass just before setting the young plants in the open air, makes the hotbed far preferable to the green-house for this kind of work. Many gardeners also raise a crop of lettuce, radishes, parsley, or carrots, in the hotbeds, before the field plants, marketing them in March, April, or May. After the field plants have been removed from the hotbeds, in March, or April, or May, and the lettuce or radishes sold, it is customary to employ the whole of the glass upon cucumbers, using a little manure to start

them. It is thus that the market is supplied with cucumbers in June before the field crop comes in. For winter work, however, in raising these crops the green-house is to be preferred; it is more manageable, and requires less labor.

The management of the more remote gardens, where less labor and manure are used, differs considerably from that of the suburban garden. The early crops are here mostly peas, beans, potatoes, sweet corn; the late ones, often upon the same land, are squashes, pickling cucumbers, and peppers, tomatoes, fall cabbage, and turnips. The hotbed is somewhat used, but less than nearer the city. The small fruits, asparagus, and dandelions, are raised in considerable quantities, and milk raising is generally an important branch of the industry of these more remote farms. The early peas and potatoes are often followed by squashes or white turnips, on the same land. Fall cabbages are also often planted after peas or early greens; and peppers are generally made to follow early lettuce. Where early potatoes or peas are to be raised with squashes, every third or fourth row of the early crop is left blank for the squashes; the squash seed planted rather late, about June 5th, and the early crop cleared away before July 10th, when the squashes begin to run. There are many of the devices of double cropping in common use in the market garden, which might be easily and profitably imitated by the amateur in his kitchen garden.

The manure used on the market garden is mostly horse manure, with some night-soil and hog manure Land intended for early cabbages and greens is usually manured in the fall with coarse manure, plowed under. The manure applied in spring is worked as fine as possible so as to be available at once for plant-food. When the horse manure is very coarse or strawy, it is used thus for hotbeds in its fresh state, but in summer it should either be thrown into a cellar to be trampled by hogs, or composted with night-soil and loam in the field. When handled in this way it does not heat excessively, and makes a manure that cannot be excelled for forcing a rapid growth of vegetables.

The preparation of the land for garden crops is a point that requires the application of considerable skill. The best gardeners plow rather deeply, ten or twelve inches; the land endures drouth better when thus handled than when shallow plowing is practiced. Many of them run a subsoil plow after the common large plow every second year, to loosen the subsoil. To make the land mellow and fine enough for most garden crops, it should be harrowed and rolled after plowing, and then plowed, harrowed, and rolled again. The roller is an indispensable tool in the garden, and is most useful in packing the surface of the soil just enough to prevent excessive evaporation in time of drouth. For this purpose it is often made to follow the cultivator in the celery field, in dry weather.

Weeds have little chance to be very troublesome in a well ordered garden. The continual hoeing and plowing kill the few that come up, and no skilful gardener will suffer them to go to seed on his land, and the manure is suffered to ferment before being applied to the land in order to destroy the seeds it always contains. The only very troublesome weeds are those which grow and mature their seeds very rapidly, such as purslain, chickweed, and the like. Even these will yield to thorough culture.

**Irrigating Market Gardens.**—The practice of irrigation is profitable, and likely to increase; in some seasons the rain fall is sufficient for the growth of vegetation; but we often get a month or six weeks almost rainless, with hot, dry winds, very trying to the succulent vegetation of gardens. When water is applied, it should be put on in sufficient quantity to soak the ground thoroughly to the depth of the roots; and as soon as it has soaked in, the land should be cultivated or hoed.

Frequent sprinkling of the surface is objectionable; it makes a crust upon the surface, and draws the tender rootlets to the surface, where they are likely to dry up if not constantly watered. To water land effectually requires an inch in depth applied every five days, or 27,000 gallons per acre. To apply this amount of water with an 1½-inch hose and a head of

40 feet would require about seven hours. If a $\frac{3}{4}$-inch hose were used with the same head it would require about six times as long to apply the same quantity. Where water may be cheaply had and applied there is little doubt that it will in many cases well repay the trouble. But wherever it is applied the land should have good drainage, otherwise a heavy fall of rain, coming after an artificial watering, might injure the crops. The land, if heavily manured and thoroughly tilled, will endure drouth pretty well without watering. Water, however, is indispensable to the management of the hotbed and green-house; and many gardeners not within reach of public works, or a natural head, have erected private water works, driven by a windmill or small steam-engine. In no particular is the skill of the gardener more conspicuous than in the raising or selection of his seeds.

**Preparing for Market.**—Another most important part of the business is the washing, packing, and assorting of the crops for market. This is usually done under the eye of the gardener himself, or intrusted only to some experienced and trusty man. It is an old maxim of trade that goods well put up are already half sold. In no trade is this more true than in the vegetable and fruit trade; clean, neat, well-washed, attractive goods always sell quickly, at good prices; while carelessly prepared stock, that is really as good, will be hard to dispose of at a fair price. The wash-house, provided with tubs, convenient benches, and sufficient shelter for the preparation of the crops for the market-wagon, is the necessary appendage of every market garden. Upon the convenient arrangement of this department much of the economy of the labor of preparing the crop depends.

**Storage of Crops.**—Among the noticeable devices of the market gardener for keeping the fall crops for winter use are, the squash-house, the celery-pit, the spinach-house, the cellar. Squashes, for keeping, need a tight house above ground, a dry air, and a temperature from 55° to 60°, which is maintained by a stove and by slight ventilation; they need picking over every ten days, to select the decayed ones. The celery-pit needs a dry, cool air, moderate ventilation, perfect protection from frost.

The celery-pit is usually made twenty-four feet or twelve feet wide, two feet deep at the sides, covered with boards supported by posts and purlines, and the boards covered with sufficient litter to keep out frost. The celery is dug in November, and stowed away, placing a little earth over the roots, and will keep well through the winter if well aired and cared for, airing it frequently. It needs to be kept dry, to be protected from frost, and kept as cool as may be without freezing.

The spinach-house, or cellar, is similar in appearance to the squash-house; the shelves, however, are only fourteen inches apart; as we do not need to work between them, it is made partly underground. As the temperature required for spinach is 30° to 35°, we need no stove, but good ventilators, and protection from frost by double walls, and covering of meadow hay, etc.

The cellar for storage of roots should be well drained and frost-proof, and provided with windows and doors for free ventilation in suitable weather. Apples and onions keep well in barrels in a cool, dry cellar; the other roots do well in bins piled about four feet deep, with openings in the sides and bottom for slight circulation of air, and a light covering of hay over them, to prevent them from wilting. They keep fresher if covered with sand, or earth, to prevent evaporation, but this is not generally practiced. Roots intended for winter marketing are often washed in the fall, and put in barrels and headed up, and then stored in a cool cellar. They come out fresh and clean at any time in winter when thus stored. The temperature of the cellar should range from 35° to 40°. If much warmer, vegetation and decay will result. The cellar of a house is not well adapted to the purpose, being too warm; especially if provided with a furnace for heating the house, as is often the case. Moreover, the vegetable cellar in spring is inevitably encumbered more or less with decaying vegetables, which are most unwholesome in the air of the dwelling.

Where many roots are raised for feeding to stock, and where cellar room is wanting, it will not cost very much to pit them. The pit is usually made four feet wide, by plowing the land and shoveling out the loam at each side; the roots are piled in a ridge about three feet deep, and lightly covered with straw or sedge, over which six inches of loam are placed, well beaten with the back of a shovel. When cold weather comes on, pile on enough litter to keep out frost, provide air-holes every rod in the length of the pit, for ventilation. Plow a deep furrow around the pit, to carry off surface water.

**Rotation of Crops for Gardening.** — Since different plants appropriate different elements or substances found in the soil for promoting their growth, a rotation of crops is quite as essential in gardening, as in the cultivation of farm crops. Care should therefore be taken that the same or similar plants should not be grown on the same soil for successive seasons. There are some exceptions to this rule, such as onions, for instance, that will sometimes thrive for successive seasons on the same land; but such instances are rare, and we believe *all* plants will do better when a change of soil is frequently made. (See ROTATION OF CROPS, Vol. I, page 107.)

**Asparagus.** — This is one of the most wholesome and delicious of all vegetables, and it is a matter of surprise that so few farmers cultivate it, with all the facilities for so doing. For market gardens, we know of nothing that will prove more remunerative, it being found in the markets early in the season at exorbitant prices, while all through the season of its growth it will find a ready demand at good prices. As to the labor of producing it, but little is required when a bed has once been established, and it will last for many years, asparagus beds having been known to be productive for more than fifty years There is said to be one on the farm of Capt. Cummings, at Quincy, Mass., that is known to be more than eighty years old, and it is still thrifty and productive.

**Varieties.** — The principal varieties of asparagus are CONOVER'S COLOSSAL, a well-known variety of large size, tender, and of good quality; MOORE'S CROSSBRED, a new kind obtained by hybridizing the Giant improved with another fine variety; it is quite productive, the shoots large, and the flavor fine; SMALLEY'S DEFIANCE, early, productive, and of good quality, but not producing quite as large shoots as those previously mentioned.

**Cultivation.** — Before sowing the seeds, they should be soaked in tepid water twenty-four hours, to hasten germination. Asparagus requires a warm, rich soil, and thrives best on a deep, sandy loam. It should never be transplanted on stony land, since the stones would obstruct the tender sprouts and prevent their growing straight, and would also interfere with the knife in cutting. Sow early in spring in drills two inches deep and rows a foot apart, and keep thoroughly clean by frequent weeding and hoeing. When grown an inch or so, thin to twelve inches apart. In the following spring the plants will be ready to remove to permanent beds. These should be prepared with more than usual care, as, when once established, the plants will yield abundantly for many years Where it can be done, the roots ought to be set not less than two feet and a half apart each way. This is a greater distance than is generally allowed; but, when the bed becomes thoroughly established, it will be found none too great. In cases where limited space renders this distance impracticable, give as much room as possible, but never have less than eighteen inches each way between the plants. Place the roots in their natural position, and cover four inches deep. A light, sandy loam, two feet deep and perfectly drained, is the most suitable. Rich, well-rotted manure, sufficient to cover the bed six inches, should be trenched into the soil to the depth of two feet, as the roots will reach that depth in a few years. During summer, water liberally with liquid manure. It should not be cut for the table during the first year, and very sparingly during the second year. The first year's shoots should not be disturbed until it is time to cut them down in the fall. The next season the bed will give a full crop, but should be annually

manured after the last cutting, and well cultivated through the remainder of the summer. On the approach of winter, cut down the stems and clear off all weeds, and cover with a dressing of manure; this should be forked in with about one quart of salt to the square rod early in the spring. Planting roots instead of seed will save a year in time. The salt serves a double purpose — that of benefiting the plants, and of keeping out the weeds.

A writer on this subject says in one of our leading journals: "He who lives in the country and has no asparagus bed has at least one sin of omission on his conscience, for which he can never give an adequate excuse. Some are under the delusion that an asparagus bed is an abstruse garden problem, and an expensive luxury. Far from it. The plants can be obtained of any seedsman at slight cost. I have one large bed that yields almost a daily supply from the middle of April till late in June, and I shall make another bed next spring in this simple way: As early as the ground is dry enough — the sooner the better — I shall choose some warm, early, but deep soil, enrich it well, and then on one side of the plot open a furrow or trench eight inches deep. Down this furrow I shall scatter a heavy coat of rotted compost, and then run a plow or pointed hoe through it again.

By this process the earth and compost are mingled, and the furrow rendered about six inches deep. Along its side, one foot apart, I will place one-year old plants, spreading out the roots and taking care to keep the crown, or top of the plant, five inches below the surface when level; then half fill the furrow over the plants, and when the young shoots are well up, fill the furrow even. I shall make the furrows two feet apart, and, after planting as much space as I wish, the bed is made for the next fifty years. In my father's garden there was a good bed over fifty years old. The young shoots should not be cut for the first two years, and only sparingly the third year, on the same principle that we do not put young colts at work. The asparagus is a marine plant, and dustings of salt sufficient to kill the weeds will promote its growth."

**Cutting and Preparing for Market.** — The cutting of asparagus in preparing it for market requires careful attention, since much depends upon its looking well when offered for sale. It should be cut early every morning, and tied up at once in bunches of about a pound each. The best knife that we have found for this purpose is a common butcher's knife filed with saw teeth for about three inches from the point. Such a knife will require grinding and filing daily. The cutting should be done before the heads burst, and when the stalks are six inches above the ground, they may be cut three or four inches below the surface. A simple frame is used for bunching, which greatly facilitates this operation. It consists of a horizontal board into which four pegs are driven, with another board set up on edge at the end of the first, and nailed to it. The pegs are so placed as to gauge the size of the bunches, the standard size being of a pound weight. The material for tying is Russia matting, this being wet before tying and drawn very tightly. Some little skill is required to have the bunches look well. When it is necessary to cut the asparagus the evening before marketing, the root end of bunches should be set in water to the depth of an inch or two, in order to keep the stalks fresh

**Beans.** — Both bush and pole or running beans are an important adjunct to every garden, they being a nutritious, healthful, and palatable diet. The large Lima is one of the richest beans for garden culture. It has broad, rough pods, is of excellent flavor, but is rather tender and late in maturing. It is properly a plant that requires a pole for support, although it is sometimes grown without, in case the vines are kept closely pruned. The best results are, however, obtained when poles are used. Dreer's Improved Lima is somewhat smaller than the former, but is of excellent quality, earlier in maturing, and very productive. Other fine varieties of pole beans are Dutch Case Knife, Giant German Wax, Horticultural Cranberry, White Cranberry, Golden Butter, and Southern Prolific. The latter is an

excellent bean for cooking in the pod. The pods grow in clusters, are very brittle and tender, and mature in seventy days after planting. This is one of the most popular varieties of the Southern States. Among the best dwarf or bush varieties are the EARLY DWARF, WHITE WAX, BLACK WAX, EARLY CHINA, WHITE MARROWFAT, etc.

**Culture.** — Being extremely sensitive to cold and frost, beans should not be planted before all danger from this source is passed. It is a good plan to start them well in a hotbed or cold frame, and afterwards transplant them in the open air. This will insure an early crop. By planting them on the reverse side of turf cut into small pieces, they can be readily transplanted without disturbing the roots. A Connecticut farmer describes this method as follows: "I take a sharp spade and go to the side of the highway where there is a wash, as the soil is pretty sure to be good, free from stone, and a close turf. I cut the turf into squares of one foot, about three inches deep, hauling these on the wagon to the place chosen for the crop. I lay them bottom up in the cold frame, and with an old knife cut each square of turf into pieces four inches square, giving nine pieces to each square. Into each of these smaller pieces of turf I stick the bean, squash, or melon seeds. I put two beans in a piece, or three melon or squash seeds. I then sprinkle soil over the bed, and when the seeds are up high enough, I take the pieces of turf with the plants, and set them where they are to grow. By this method the roots are not broken, and they grow right along. I take two squares for a hill of beans, which gives me four good plants in each hill."

This is an excellent method for planting Lima beans, since they are generally so late in maturing that they require an early start. The dwarf or bush beans are generally more hardy than the running varieties, and, as a rule, should be planted two weeks earlier that the latter. Beans succeed best in a sandy loam moderately manured, although they will do well in a variety of soils. If the soil is too rich the ground will be mostly in leaves and vines. In garden culture beans should be planted at intervals throughout the season for a succession of crops, finishing the planting about the first of July. For bush beans, make the drills two inches deep and two feet apart, planting the beans three inches apart in the drill, covering not more than two inches deep. Pole beans should be planted in hills, according to the variety, from three to four feet apart, and five or six beans to each hill. They do best when planted with the eye downward. When the plants are well established, thin out to four plants to a hill. They require poles from six to ten feet high to climb upon. The soil should be stirred often to be kept loose and friable, and for exterminating the weeds; but only when dry, since earth scattered on the leaves when wet with dew or rain will be liable to cause them to rust.

**Culture of Lima Beans.**—Lima beans are very susceptible to cold and wet, and are apt to rot in the ground, consequently they should not be planted when the soil is wet or cold. If planted directly preceding a shower, or before the ground has dried off after one, they will be liable to suffer from it. This variety requires much greater care in this respect than any other. It is always well to plant an extra drill for supplying the places of such plants as fail to thrive. They should have plenty of room for growth, consequently require planting further apart than other varieties. Some of the most successful gardeners plant in hills five feet apart each way, with only two plants to a hill, and one pole to each plant. Poles six feet high will be sufficient, and the runners should be picked off when they reach the tops of the poles, also all the side runners a foot away from the poles, which will cause them to be more productive, and the strength of the plant run less to vines. It is considerable trouble and labor to keep the runners back, but the additional yield thus obtained well repays. When transplanting from a hotbed, great care should be used not to disturb the roots.

Mr. W. D. Philbrick gives his method of transplanting Lima beans as follows: "The seed is planted in an old hotbed about May 1st to 10th. Under shelter of the glass the seed

rapidly germinates and grows; three or four seeds are placed for each hill in squares marked out on the bed eight or nine inches square. As planting time approaches, the plants are hardened by taking off the glass several days, and the day before planting they should be thoroughly soaked with water, so that the earth will not crumble from the roots in transplanting. This is effected by pressing into the ground, around each hill, a square ring of sheet zinc, eight inches square by three inches high, to hold the earth together, and then passing a spade under the hill, it can be lifted, ring and all, and carried to the place intended for growth. This is precisely the way in which we transplant melons and cucumbers, and by means of it gain at least two or three weeks, which in our short season is well worth while. Only a few of the rings are required, as they are taken up as soon as the hill is planted and used for the next one."

If the pods are gathered before ripening on the vines, or when green, but well filled, the beans are much nicer for winter use, than when allowed to ripen before gathering.

**Beets.**—The early varieties of beets are very useful for the leaves as "greens," as well as for the roots. Soaking the seed in tepid water for twenty-four hours before planting will cause them to vegetate much sooner. A deep, rich, yet rather light loamy soil which has been well manured the previous year, is excellent for beets. When an early crop is desired, the seed should be sown as soon as the ground can be worked, and the principal crop in the first week in May; but for winter use, sow as late as June. The sowing should be in drills about an inch deep, and from fifteen to eighteen inches apart. The weeds should be kept down by frequent cultivation. For further directions respecting beets, see Vol. I, page 364.

**Borecole, or Kale.**—This is a variety of cabbage, the leaves of which do not form into a compact head, but are generally loose and curled or wrinkled. It is more hardy than the cabbage, and is thought to be improved by the touch of frost, and makes excellent greens for winter and spring use. This plant is sown and cultivated the same as cabbage, and is sown from May to June. For early spring use, the Dwarf German and Green Curled Scotch varieties are sown in September, and protected during the winter with a covering of straw or litter. Other varieties are Dwarf Purple, Improved Siberian, Improved Garnishing, and New Russian. Sea Kale grows spontaneously in some parts of England. Sow the seeds early in the spring in well-manured, deep tilled soil, covering about an inch deep, with rows two feet apart. Thin out the plants to six inches in the rows, and before winter cover with straw or leaves. The following spring transplant in hills three feet apart each way. Sea Kale is grown for its blanched shoots, which are cooked like asparagus.

**Broccoli** is also a species of cabbage that resembles the cauliflower. The principal varieties are the Early Purple, a hardy kind with compact, large heads of brownish purple color, White Cape, sometimes called "Cauliflower Broccoli," a white variety resembling the cauliflower, and Walcheren, also hardy and of fine quality. For early crops, the seed should be sown in a hotbed, and the plants transplanted. The plants should be set in rows two feet apart, with the same between the rows. They should be well watered until they become fairly established in the soil.

**Cabbage.**—The cabbage thrives best in a deep, rich soil, that has been thoroughly pulverized. It is a hearty feeder, and requires a plenty of nitrogenous manure, and also phosphates. For early use, the seeds should be sown in hotbeds in February or March, or they may be sown about the middle of September, and the plants kept over winter in cold frames. The former method is preferable where the winters are severe. Transplanting should be done in the spring as soon as the ground will admit of being worked, the plants being set in rows two feet and a half apart. They should be set in the ground up to the first leaf, no matter how long the stem may be. For winter use the seed should be sown in May

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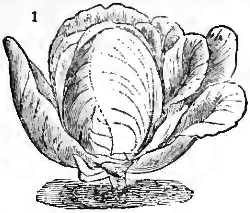

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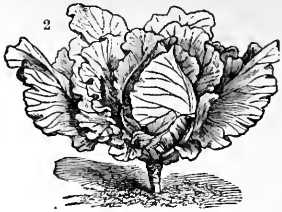

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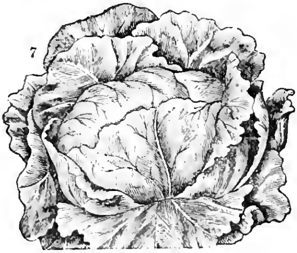

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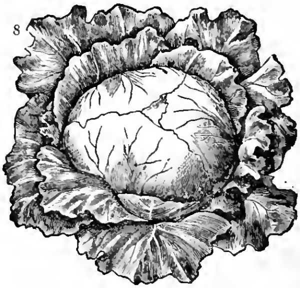


1. Early French Oxheart Cabbage.
2. Early Winnigstadt Cabbage.
3. Early Jersey Wakefield Cabbage.
4. Henderson's Early Summer Cabbage.
5. Large Flat Dutch Cabbage.
6. Drumhead Savoy Cabbage.
7. Early Improved Flat Brunswick Cabbage.
8. Large Late Drumhead Cabbage.

or June, and the plants set further apart than for the early crop, the distance being two and a half by three feet. At the South they may be set in the fall. Producing cabbage on the same soil for two or more successive years is not to be recommended, since no plant requires a change more frequently than this. The disease known as "clump root" is supposed to be in a great measure due to exhaustion of soil from repeated planting of this crop. Two or three years should intervene between cabbages occupying the same piece of land. The plants should not crowd each other in the seed bed, and should have ample room for growth in the hills or rows. The ground should be kept loose by the frequent use of the hoe or cultivator, and when the plants are fully half grown, the soil should be stirred deep, and hilled up around the stalks. Stable manure that has been well fermented should be used, also bone dust, guano, and salt. The latter applied just before the plants commence heading, will make them head up more compactly. Hog manure is generally regarded as objectionable for use in the cultivation of this crop. The cuts of the different varieties of the cabbage which we insert, also of other vegetables in this department, were copied by permission from the catalogue of W. F. Dreer of Philadelphia, Pa., and represent some of the leading varieties at present cultivated. Pyrethrum powder dusted over the cabbages will destroy the cabbage worm, and drive away the flea-beetle. It should be mixed with wheat flour in the proportion of one part of Pyrethrum to four parts flour, and be lightly dusted over the plants.

**Carrots.**—The garden cultivation of carrots is substantially the same as that recommended for the field, which has already been given in connection with ROOTS AND ESCULENT TUBERS, Vol. I.

**Cauliflower.**—This is a variety of cabbage which differs from the other varieties of its species, the parts eaten being the flower buds and stalks which form a compact mass or head. It is a delicious vegetable, and should be more frequently cultivated in the farm garden than it is at present. For sowing the seed and transplanting the same directions are recommended as for cabbage. It requires a deep rich soil, and an abundance of moisture in order to be grown in perfection. During a dry season, it will require watering artificially. Careful cultivation should be given, such as frequent and vigorous stirring of the soil, and a liberal supply of rich liquid manure in order to keep up a continuous and rapid growth. The blanching of the heads will be facilitated if the leaves are gathered loosely together and tied over the top of the head after they are fully grown. There are several varieties in cultivation, among those most early are the EARLY DUTCH, ERFURT EARLY DWARF, EARLY PARIS, EARLY SNOWBALL, and EARLY LONDON; the later varieties,—the ALGIERS, IMPERIAL, NONPAREIL, VEITCH'S AUTUMN GIANT, and the WALCHEREN.

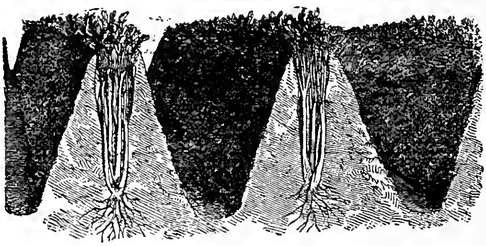
**Celery.**—This is a most delicious salad, and is as healthful as it is palatable, it being regarded as excellent for strengthening the nerves. With a little extra care and labor this luxury might be supplied to every farmer's table. The seeds are frequently started in a hot-bed, especially for the early crops, the plants to be transplanted as soon as they will bear handling, which is when they are from six to eight inches high. When started in the open land, a sheltered place should be selected. Two methods of transplanting are practiced, viz.: that of setting the plants upon the surface like other vegetables, and the far better one of planting in trenches. By the latter method, the trenches are dug a foot and a half deep, and about a foot wide, and the bottom filled six or eight inches in depth with manure that has been well fermented.

This should be covered with soil to the depth of about three inches, which should be mixed with the manure and pressed or trodden down slightly to render it more compact, after which there should be two or three inches of fine soil added in which to set the plants. The soil should be very rich and deep, and the plants, after being carefully taken from the seed bed, and having the suckers removed, should be planted in rows from six to eight inches

apart in the row. The trenches or drills should be three feet apart. Draw the earth around the plants as they advance in growth, but leave the hearts or center of the tops uncovered until the final soiling, care being used not to get the soil into this center of the plant. This earthing should be done when the plants are dry. Celery being a saline plant, an occasional application of salt will improve its quality. The soil should be kept loose around the plants during the season of growth, and liquid manure frequently applied. From the middle of August to the middle of September is the most favorable time for the growth of celery, the days being warm and the nights cool, with a considerable gathering of dew. A moderate or light frost will not injure celery, but whenever a heavy, killing frost is anticipated, it should be cared for; it is best, however, to leave it out as long as possible with safety.

There are several varieties of the celery plant, some of the principal being the GOLDEN HEART, DREER'S IMPROVED WHITE, BOSTON MARKET, GIANT WHITE, MAMMOTH RED, etc.

**Blanching Celery.**—About four or five weeks before celery is wanted for table use, the stalks should be blanched by covering with soil so as entirely to exclude the light. This operation consists in banking up the plants with earth on each side nearly or quite to the tops,



CELERY PLANTS BANKED UP.

as shown in the accompanying cut. Market gardeners usually blanch a large portion of their celery in this manner early in the season for early sales. When celery is to be sent to market late in the fall or early in the winter, it is generally stored in trenches.

**Wintering Celery.**—An authentic agricultural writer gives the following methods of storing celery for winter and spring use: "Market gardeners sometimes leave the celery where it grew, banking it up to the tops with earth, and at the approach of severe weather, covering with leaves. There is the risk of being unable to get out the celery when wanted, when left thus; hence the crop for use in late winter is stored in trenches, where it is accessible at any time. The trenches must be where water will not settle in them, and should not be over ten inches wide, the depth being equal to the height of the plants. The celery is placed upright, the plants being close together, but no earth is put between them. The tops are to be covered with leaves, straw, or coarse hay, but not until the weather is likely to be severe, though the covering material should be at hand to be ready in an emergency.

To avoid injury from heating, the packing in trenches is delayed as long as it is safe to do so. But the plants in the rows are protected by roughly earthing them up to the tops three or four weeks previous. The tops will not be injured if the thermometer falls five or six degrees below freezing, and the covering may be slight at first, to be increased as the cold is more severe, until finally it is six or eight inches thick. Boxes may be used for storing celery in the cellar. This is a neat and ready way, but not practicable in a warm cellar. Instead of boxes, boards may be used. A row of boarding is placed nine inches from the cellar wall, and as high as the tops of the celery; this is to be filled with the upright stalks as if it were a trench. At nine inches from this two more rows of boarding are set up; also

nine inches apart, forming another trench, distant from the former by its own width; this is to be filled, and so on. This will leave the celery in strips nine inches wide, separated by spaces the same width. The spaces are to avoid the heating, which would take place if larger masses of it were placed together.

If the floor of the cellar is cemented or bricked, a couple of inches of the soil should be placed on it before the celery is packed. It will be necessary to use some strips or stays to hold up the boards. With a cellar bottom of earth, no soil is needed, and the boards may be held up by driving stakes. With such a mass of vegetable matter, considerable heat is given off, and free ventilation will be needed to keep the temperature low enough to prevent injury." As wanted for use, take from the end of a single trench, never leaving what is left uncovered or exposed to the light.

**Chervil.**—This is a plant that is used as a small salad, when young and tender; also for flavoring soups, etc. It is aromatic, and resembles parsley in appearance. Sow the seed either in the fall or spring, in drills half an inch deep, and about a foot apart. After the plants are sufficiently large, thin out to about seven or eight inches apart. Keep free from weeds, and during very dry weather water occasionally. The principal varieties are the Curled and the Tuberous Rooted.

**Chicory.**—The chicory plant grows wild in many parts of Europe, but is cultivated and used in this country by being mixed with coffee, the roots being first dried and roasted and then ground like coffee. It is a perennial plant, with a root resembling that of the carrot in form, but white in flesh; stem growing from two to five feet high, with a rather large blue flower, and leaves resembling those of the dandelion. When largely used, the root has a tendency to produce diarrhœa, but when mixed with coffee in the proportion of one-fourth chicory to three-fourths of coffee, the drink is considered more healthful than pure coffee, and also of better flavor. The leaves, when bleached, are used as a salad. The best varieties are the Large Rooted or Coffee, and the Whitlœf. The seed should be sown in the spring, in drills half an inch deep, in good mellow soil, the after culture being the same as is recommended for carrots.

**Corn (Sweet).**—For garden culture and table use, only the sweet or sugar varieties should be grown. These should have a warm and moderately dry soil, being liable to rot in one that is cold and wet. Plant the earliest varieties first, as soon in the spring as the ground will admit, in hills three feet apart each way, six seeds in a hill, covering about half an inch; afterwards thin out to three of the best plants to a hill. Later varieties should follow, which are generally better in quality than the very earliest. The culture is the same as for field corn. There should be a succession of plantings every two weeks from April to July, in order to furnish a continual supply of this excellent food during the season.

**Cress or Peppergrass.** — This is extensively grown as a small salad. The best varieties are the Broad Leaved or common cress, the Extra Curled, and the Australian. It should be sown early in the spring quite thickly in shallow drills. The sowings should be repeated at short intervals during the season, as it is apt to soon run to seed.

**Cress (Water).** — The leaves of this plant are used as a salad, and when eaten with salt, like celery, have a very agreeable, pungent flavor. The best varieties are the Erfurt and the common Water Cress. These plants require a stream of running water, pond, or ditch, and may easily be grown by sowing the seeds along the sides of these, where it will grow without care except to prevent the interference of weeds. Transplanting is regarded as a surer method than sowing. This may be done from March till August. The distance between the plants should be ten or fifteen inches.

**Cucumbers.** — These should find a place in every garden, they being a great relish for table use when fresh from the vines, or when used as a pickle. For table use the earlier

varieties should be planted. but for pickles, the later kinds should be chosen and planted during the first two weeks of June, and should be gathered when two and a half to three inches in length. There are many fine varieties, such as the EARLY CHESTER, EARLY RUSSIAN, EARLY WHITE SPINED, LONG GREEN PICKLING, etc. Cucumbers thrive best in moist, rich, loamy soil. It is a good plan to start them in a hotbed, when an early crop is desired, and afterwards transplant them when the soil is warm enough. They should not be planted in the open air until the weather is warm and settled. The hills should be made four feet apart each way, and previously prepared by mixing in each a shovelful of fermented manure or a good supply of wood ashes, this to be mixed with the soil, and slightly covered with earth. Plant about ten seeds in a hill and cover half an inch deep. When all danger from insects is passed, thin out the plants, leaving three or four of the best in each hill. Cultivate frequently, keeping out all weeds, and the soil loose about the plants. The cucumbers should be picked when large enough, and not left to ripen on the vines, as this injures their productiveness.

**The Cucumber Beetle or Striped Bug.**—This is a great pest to the gardener, as it generally makes its appearance as soon as the plants are well out of the ground, or shortly after, frequently destroying them entirely. For this reason, a constant watch must be kept for its appearance. Dusting the vines with one part Pyrethrum powder mixed with four parts of wheat flour will drive these bugs away. Frequent dusting of the vines with plaster dust, or wood ashes, when wet with dew, is a good preventive. Another good remedy is to put about four quarts of droppings from the hen roost into a pail of water and after it has stood about six or eight hours, sprinkle the liquid on the cucumber vines, and it will drive the bugs away, or prevent their attacks, and will also fertilize the soil. The sediment at the bottom of the pail should never be used, as it will injure the vines, and the liquid should not be made stronger than we have recommended for the same reason. A cloudy day is the best time to apply the liquid, since it will remain longer before becoming dried off.

**Citrons.**—The culture for the citron should be the same as recommended for MELONS, which see.

**Dandelion.**—This plant is found growing wild in a large section of the country, the leaves being excellent for "greens" in the early spring. The root is also very healthful, and when dried and roasted, is frequently used as a substitute for coffee. The dandelion is being cultivated at present to a considerable extent, and well deserves a place among the garden vegetables. The seeds are sown early in the spring in drills eighteen inches apart; thin out to six inches in the drills, keep clear of weeds, and the following spring they will be fit for table use.

**Egg-Plant.**—When an early crop is desired, the seed should be sown thickly in a hotbed, and transplanted, or in a warm, dry, sheltered place in the open ground, where the young plants will be well protected, since they are apt to be tender. When they are three or four inches high, and the weather is sufficiently warm, they should be transplanted into rich soil in hills about two and a half feet each way. Keep the ground free from weeds, and draw the earth around the plants as they advance in growth. The principal varieties are the EARLY LONG PURPLE, NEW YORK IMPROVED PURPLE, and BLACK PEKIN, all of which are hardy and prolific.

**Endive.**—This plant is used as a salad, and when well bleached is very palatable. It is also very wholesome. The best varieties are the GREEN CURLED, which is the most hardy of all, the WHITE CURLED, the FRENCH MOSS, and the BROAD LEAVED BATAVIAN, the latter being used principally for flavoring soups. Endive requires rather moist, well pulverized, rich soil. For early use, sow in a hotbed, or in a warm sheltered spot in shallow drills.

When two or three inches high, transplant or thin out the plants to eight or nine inches apart, and in dry seasons water freely to keep the plants in rapid growth, and consequently in a crisp and brittle condition. For a continual supply the seeds should be sown successively every two or three weeks until midsummer. The leaves may be blanched by gathering them together at the top, and tying, to hold them in this position. This should be done when they are quite dry, or they will be apt to rot. When wanted for winter use, the plants may be taken up carefully with a ball of earth attached to each, and placed close together in a dry cellar or cold frame, when it can be used during the winter as desired.

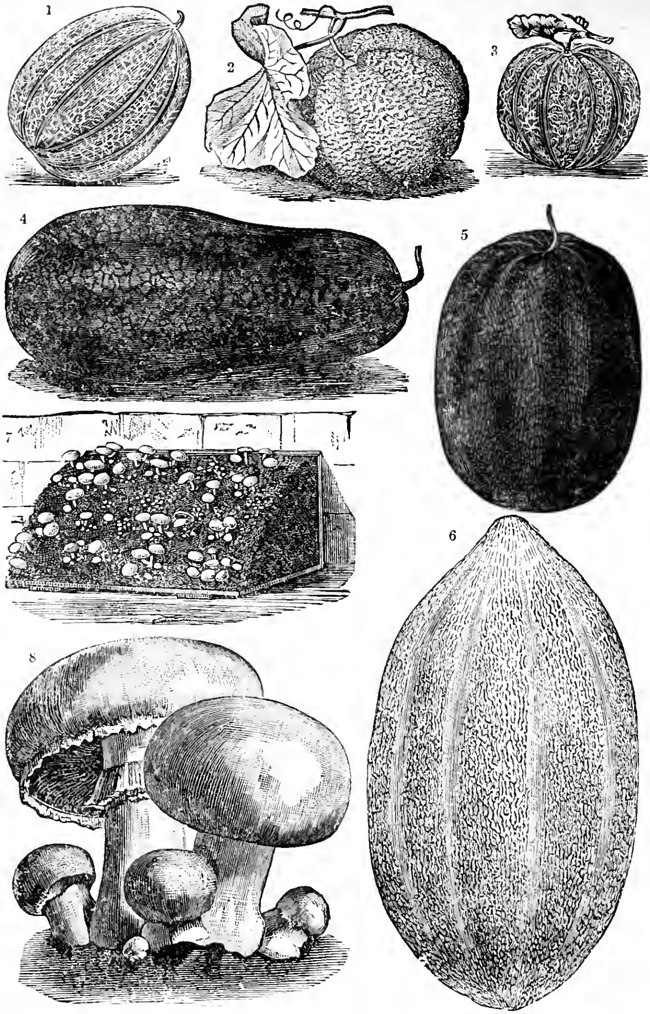
**Garlic.** — The garlic plant succeeds best in light, rich soil. Plant in April or May in drills fourteen inches apart, and five or six inches apart in the rows. The soil should be kept free from weeds, and when fully grown, which will be about the last of July or first of August, the bulbs may be harvested the same as onions.

**Horse Radish.** — This plant, the roots of which when grated are used as a condiment, is a very profitable product when grown near cities, where it finds a ready market at remunerative prices. We have known this crop to net from two hundred to four hundred dollars per acre. Besides being palatable when eaten with meats, it is a stimulant in promoting digestion, and very healthful. It is cultivated principally for its roots, which are white, and very sharp and pungent in taste, but the leaves, when young and tender, are used for "greens," or as a pot herb. The soil should be deep and rich, a rich loam being the best, although it will grow on almost any soil of fair quality. Good crops have been produced on even a mucky soil that was quite wet. The ground should be deeply plowed. This crop is generally propagated by planting pieces of the root. The planting should be in the spring, in rows about eighteen inches apart, the pieces being covered three or four inches deep. Press the soil closely around the root, and hoe often enough to keep down the weeds. It is better after remaining in the ground over winter, and is harvested very early in the spring, being plowed or spaded up, the roots penetrating quite deep into the soil. A few roots in a garden will suffice for family use.

**Leek.**—The leek, a plant of the onion genus, is, as an article of food, more delicate flavored than the onion, and is used in soups, and boiled with meat, etc., the lower part of the plant being eaten. It is a very hardy plant and easily cultivated. It thrives best in a light but well enriched soil. The seed should be sown early in April, in drills one foot apart, and one inch deep. When the plants are five or six inches high, they should be transplanted into a rich soil in rows ten or twelve inches apart each way, as deeply in the soil as possible in order that the neck or lower part of the plant may be blanched. Keep the ground free from weeds and draw the soil around the plants as they grow.

**Lettuce.** — For an early crop sow the seed in a hotbed in February, and transplant on a bed well prepared in some sheltered corner in April. The soil should be light, warm, and rich, and the seed lightly covered. The richer the soil, and more rapid the growth, the better flavored, more tender and crisp the leaves. The head varieties are the best. These should be set a foot apart each way. Care should be used not to sow too thickly where other varieties are grown. There should be successive sowings from time to time until July. An early crop may be had by sowing in September and transplanting in a cold frame, where the plants will head during winter and early spring.

**Melons.** — Melons thrive best on a light, warm soil that has been highly manured with perfectly decomposed compost, or manure that has been well fermented. A sandy soil thus enriched will produce excellent melons of any kind. The fertilizing substance should be well worked into the soil, in and about the hills, and the planting done when the land is quite warm and all danger from frost is passed. Soaking the seeds in lukewarm water twenty-four



1. Netted Pine Apple, or Nutmeg Musk-Melon.
2. Green Citron Netted Musk-Melon.
3. Jenny Lind Musk-Melon.
4. Mountain Sweet Water-Melon.
5. Black Italian Water-Melon.
6. Casaba, or Persian Musk-Melon.
7. Mushroom Bed.
8. Mushrooms Grown from Spawn.

hours before planting will hasten germination. Plant in hills five or six feet apart each way, scattering a dozen seeds in a hill, and after they are out of danger from bugs, thin out the plants to three or four to the hill. When four or five rough leaves have grown, the lateral branches or vines will start sooner if the end of the main shoot is pinched off, thus also strengthening the growth of the vines, and causing the fruit to come to maturity earlier. Citrons and water-melons require much more room for growth than muskmelons, and should be nine or ten feet apart. Keep the soil free from weeds. Pumpkins, squashes, and citrons should never be planted near musk or water-melons, as they will hybridize very readily.

**Varieties of Muskmelons or Cantaloupes.** — The earliest variety of the muskmelon is the Jenny Lind, a small variety of excellent flavor. Other fine sorts are the Green Citron, Bay View, Cassaba, New Surprise, Large Musk, the largest variety, Nutmeg, etc.

**Varieties of Watermelons.** — Among the best varieties of the watermelon are the Mountain Sweet, Cuban Queen, Long Carolina, Black Italian, Early Oval, and Black Spanish.

**Mushrooms.** — The value of mushrooms as an article of diet has not been fully appreciated in the United States, but in France and Germany they form an important part of the food of the people. The mushroom is wholesome and nutritious, as well as a delicious food, when properly cooked, and needs only to be better known to be more generally appreciated in this country. The *Agaricus campestris*, or common mushroom, is the only species that is generally grown artificially. It is botanically described as follows: Stipes (or stalk) two or three inches in length, white, solid, fleshy, furnished with an annular veil (a thin membranous substance encircling the stalk); pileus (cap, or edible part) fleshy, dry, convex, convexoplane, white, changing from yellowish to brownish; gills (thin parallel plates underside of the cap) free, ventricose (swelling unequally on one side), pink, changing to deep purplish brown; flesh (internal substance) white.

Mr. B. K. Bliss thus describes the culture of mushrooms: "Anyone in possession of an outhouse or cellar, or who can command a temperature of from 50° to 60°, may at any time secure a good crop of mushrooms. The best method is to procure (fresh from the stable) as much short manure as is necessary to make a bed from fourteen to eighteen inches deep, and any size the house can conveniently hold; throw the manure into a heap for a few days, until it becomes heated and the greater part of the moisture is thrown off; then spread it out for a day or two until dry and quite cool; after which put it again in a heap, and allow it to remain five or six days; it will then be fit to make a bed, which must not be deeper than stated above. As soon as the heat is about 74°. the bed is ready to receive the spawn. It requires to be broken into pieces about the size of a large walnut, and placed in the manure about two inches below the surface, and six inches apart. The bed should then be covered about two inches deep with fine, light soil, and pressed down evenly. If the temperature is right, the mushrooms will make their appearance in from four to six weeks, according to the season. After the bed has been spawned, do not water unless quite dry, and, when necessary, use lukewarm water only.

**Propagation of Mushroom Spawn.** — The method of propagating mushroom spawn has been definitely given by Prof. T. Taylor, formerly microscopist of the Department of Agriculture at Washington: "Summer is the best time for performing this operation. Procure some horse manure; if there is a sprinkling of short litter with it, so much the better; cow dung and light loamy soil, or road scrapings, in about equal proportions; it is not particularly necessary that they should be in exact quantities. I mention this in passing, as an idea sometimes gets abroad that unless everything is mathematically adjusted by number or weight it would be folly to expect a satisfactory result. Wash these ingredients together with water into a thick mortar, and spread it out three inches in thickness in an open shed to

dry. As soon as firm enough, cut it with a spade into squares of seven or eight inches; set them on edge, and turn them occasionally to facilitate their drying. When they will admit of being handled with safety, cut with a knife two or three holes, about two inches in diameter, little more than half through the brick, and fill each hole with good spawn,—which can be obtained of almost any seedsman,—plastering it over with a portion of what was cut out. They should now be left until quite dry. Have ready a quantity of fermenting manure, which has been well sweetened by frequent turnings. Spread a layer of this six or eight inches in thickness, and build the bricks on it with the spawned side uppermost, drawing the pile up to a point; then cover the whole with warm manure. A genial warmth of about sixty degrees will be sufficient to cause the spawn to run through the whole of the bricks. When this takes place, the process is ended. The brick can be laid aside in a dry place, and the spawn in them will keep good for years."

**Mustard** plants are frequently used as a small salad, and for "greens," which are excellent, as well as for the seed. The varieties are the Black or Brown, White, and Chinese. Sow thickly in shallow drills, eight inches apart, early in the spring, when grown for salad or "greens." When grown for seed, see directions for field culture of this crop in Vol. I.

**Nasturtium or Indian Cress.**—There are two varieties of this plant, the tall and the dwarf. It is cultivated both for use and ornament. The seed pods and foot stalks are gathered when green, and pickled in vinegar, and the leaves for mixing with salads. The flowers are of a beautiful orange color. The seeds should be sown in drills about an inch deep, in light, rich soil. The tall variety may be trimmed on brush, trellises, or fences, and the dwarf in beds, for which they make a beautiful ornamental border.

**Okra or Gombo.**—The young green capsules or pods of this plant are used for seasoning soups, stews, etc., to which they impart a rich flavor. The seeds should be sown in rich soil, as soon as the ground has become sufficiently warm, in hills or drills three feet apart. Thin the plants to three in a hill, or ten inches apart in the drills. The seeds should be planted rather thickly, as they are liable to rot in the ground. Cover an inch deep, and hoe frequently, bringing the earth up towards the plant to support the stems. The young pods can be gathered and dried for winter use, and the ripe seeds are sometimes used as a substitute for coffee.

**Onions.**—See directions for this crop in Vol. I, department of Roots and Esculent Tubers.

**Parsley.**—The leaves of this plant are used principally for garnishing dishes of meat for the table, and for seasoning soups. Among the different varieties most cultivated are the Double Curled, Dwarf Curled, Moss, and Fern Leaved. If the seeds are soaked in warm water for twenty-four hours before sowing, it will hasten germination, as they are quite slow in this respect, and do not appear above ground frequently in three or four weeks. A rich, mellow soil is preferred for the cultivation of this plant. Sow early in April in rows one foot apart, and cover half an inch deep. Thin out the plants six inches apart in the rows, and keep free from weeds. Water in dry weather. To have parsley green during winter, take up the plants carefully with plenty of soil about the roots, and place in a light cellar, treating the same as in open culture.

**Parsnips.**—See the same in the department of Roots and Esculent Tubers.

**Pease.**—No farm garden is complete without a good supply of pease, they being one of the most delicious, as well as nutritious, of garden vegetables. The early kinds should be first planted as soon in the spring as the ground will admit, and a succession of some later varieties every two weeks, in order to have a constant supply. The early kinds are not as

large or as rich in flavor as some of the later varieties, but, coming early in the season, they are vegetables that could not well be dispensed with. The varieties are too numerous to mention; among the best might be mentioned the CHAMPION OF NEW ENGLAND, CHALLENGER, MARROWFAT, BLACK EYE, PRIDE OF THE MARKET, and the SUGAR DWARF, the latter having edible pods and used in a green state, the same as string beans. Soil for pease should be moderately rich; otherwise the growth will be too much in vines, with a light crop of pease. Fresh manure should never be used, but that which has been well composted. The dwarf varieties are usually planted in double rows from three to four feet apart, and bushed when from four to six inches high. They should be planted rather deep, especially if the soil is dry, as they are thus made more productive, the vines lasting later in the season. The larger and later sorts do better to be planted a greater distance apart than the dwarf kinds, leaving a broad space for low-growing vegetables between the rows. Keep free from weeds, and the soil loose and friable. In cultivating, draw the earth up around the stalks; they should be earthed up in this manner three or four times during their growth. If the soil is dry at the time of planting, soak the seed in tepid water twenty-four hours before putting in the ground. During a dry season, watering will be a great benefit.

**Peppers.**—Being rather tender plants, and late in starting, it is better to sow peppers in a hot-bed in March, or in a bed in a warm, sheltered place early in May, and transplant in good rich mellow soil; or the seed may be sown in the open ground, when all danger of frost is passed. The plants should be set in rows sixteen inches apart, and the same distance apart in the rows. The largest growing varieties may perhaps require a little more space than this. Cultivate frequently, keeping out the weeds, bringing the earth up around the plants a little in one or two hoeings.

**Potatoes.**—A few potatoes of the earlier kind, should be planted in every farm garden; also sweet potatoes in those sections where they will succeed. For directions respecting the culture of this crop, see department of ROOTS and ESCULENT TUBERS, Vol. I.

**Pumpkins.**—The pumpkin is principally cultivated as a field crop for dairy purposes, the large and coarse growing varieties being generally planted for that purpose. There are, however, a few of the small varieties that are cultivated for culinary purposes, such as the making of "pumpkin pies," so famous in the days of our forefathers, and which at the present time have unfortunately become nearly superseded by the squash. The best varieties for this use are small in size, and deep yellow in color of flesh, which is fine-grained, sweet, and of excellent flavor. In field culture the practice is to drop two or three seeds in every second or third hill of the corn-field, but when cultivated separately on a large scale, or a few plants in the garden, the seed should be planted in hills eight feet apart each way, three plants to a hill, and treated in the same manner as recommended for melons and cucumbers.

**Radishes.**—In the cultivation of radishes the soil should be very rich, light, and mellow, since their value depends principally upon their rapid growth. Sow in drills ten inches apart, and thin to two inches in the rows. For very early use in spring sow in a hot-bed in February, and in the open air as soon as the ground can be worked, sowing at intervals of ten or twelve days as long as wanted. The turnip-rooted and olive-shaped are best for summer sowing. The winter varieties should be sown in August, and be taken up before severe frost, and stored in a cool cellar or pit, where they will keep fresh and tender all winter; but before being used, they should be placed in cold water for an hour or two. As soon as the first leaves appear after sowing, dusting with soot, wood ashes, or air-slaked lime will save them from the black cabbage and turnip fly.

**Rhubarb.**—This plant is indispensable to every good gardener. There are two very fine varieties: the VICTORIA, which is the largest and best, and the LINNÆUS, a large, tender,

and early kind. It may be grown from seeds or pieces of the roots, the latter saving two years time. When seeds are sown, they should be put in drills eighteen inches apart and covered with fine soil. When the plants are strong enough, thin out to six inches in the rows. In the following spring transplant the roots into deep, rich soil three feet apart each way. The stalks should not be cut until the third spring after sowing. The best way is to plant pieces of the roots, which will produce stalks that may be used in one season. Give frequent cultivation, and cut out all the seed stalks as soon as they appear.

**Salsify or Oyster Plant.**—This is a fine vegetable that is cooked the same as carrots, or, after being boiled, is fried like oysters, which it much resembles in flavor. The culture is the same as that recommended for carrots and parsnips. It is a hardy plant, and may remain in the ground all winter for early spring use. It succeeds best in a light mellow soil, that has been well enriched and tilled quite deep.

**Spinach.**—This is an important crop for the market gardens, and should be cultivated in every farmer's garden, as it furnishes excellent "greens" that resemble in flavor the leaves of the beet plant. There are many varieties, the ROUND-LEAVED VIROFLAY being of the most luxuriant growth, and the NEW ZEALAND and PRICKLY or FALL variety being the most hardy and of excellent quality, although the latter is not as productive or as large-leaved as the others mentioned. The New Zealand endures the heat and drouth of summer the best of any. For spring and summer use, sow as early as practicable in the spring, in rich, mellow soil, either broadcast or in drills one foot apart, and every two weeks for a succession. Drill sowing is to be preferred, as it admits of after culture. As it grows, thin out for use, keeping it clear of muck. For winter and early spring use, sow in September in rich, well-manured ground; in fact, the soil cannot be too rich, since the richer the soil the more delicate and succulent will be the leaves. As cold weather approaches cover with straw, and remove it early in the spring. Spinach, when properly cared for, may be had for use during nearly all the year.

**Squash.**—The squash plant is very sensitive to cold, and should therefore not be planted in the Middle and Northern States until after all danger of frost is past. There are many excellent varieties, both winter and summer, and new ones are constantly making their appearance. The land should be made very rich, and plenty of room should be given the thrifty growing vines The hills should be at least ten feet apart. Deposit the seed when the soil is warm, using plenty of seed, thinning out to two or three plants in a hill after they have commenced growing well. Dusting the vines with Pyrethrum powder, plaster, soot, wood ashes, etc., as recommended for cucumbers, will aid in driving away the beetle or bug. The vines should be closely watched in sections where the maggot proves destructive. The eggs from which it is hatched are laid on the stem near the root, and at the base of the leaf stem, or point of union of the leaf, stalk, and vine. The maggot bores into a vine, eating its way through the pith, and if left undisturbed for a few days, will frequently destroy a large vine. When detected in season, the worm may be killed with a sharp-pointed wire; but the better way is to guard against the bugs in the first place, and, if possible prevent them from laying their eggs in the vines.

**Tomatoes.**—The tomato has become one of the most important of garden vegetables, and may be canned and used in many ways throughout the entire year. It was formerly grown in gardens simply for ornament. Sow the seed in hot beds or boxes of earth in the house, placing the box in a south window where the warm sunshine will aid in starting the young plants. Plant out in the open air in a well-prepared bed, as soon as all danger of frost is passed. Set one plant in a hill, the hills to be four feet apart each way. The soil should be made rich with well decomposed manure mixed with it. Water the plants freely at the time of transplanting, unless it be in misty or rainy weather, and shield from the hot

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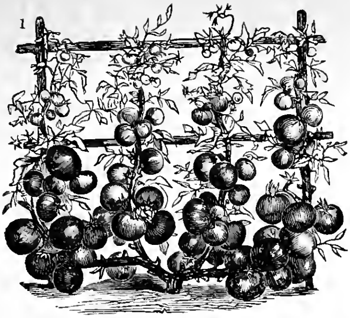

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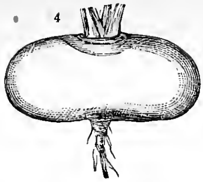

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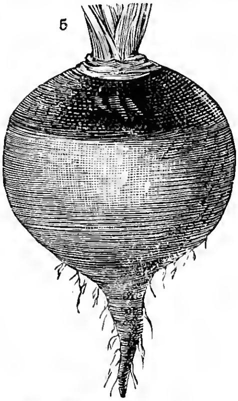

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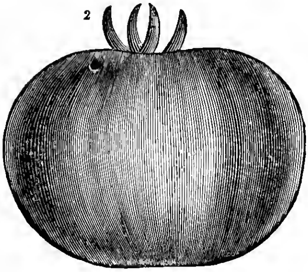

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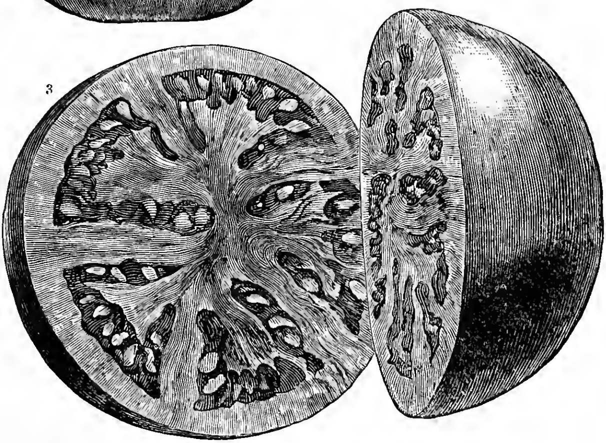


1. Dreer's Selected Trophy Tomato.
2. Early Paragon Tomato.
3. Early Acme Tomato.
4. Early White Flat Dutch Turnip.
5. Improved Yellow Purple Top Ruta Baga, or Swedish Turnip.

sun for two or three days. By pinching off the side branches, the fruit will mature earlier. The vines should be trained on a trellis, or tied to a stake, since this will increase their productiveness, and improve the quality of the fruit, and also keep the fruit from lying upon the ground, where it will be liable to rot. Frequent culture should be given, and the vines allowed plenty of room for spreading. Among the large varieties best for cultivation are the ACME, MAYFLOWER, LIVINGSTON'S FAVORITE, ARLINGTON PARAGON, LARGE YELLOW, etc. Among the small varieties for pickling or making preserves are the STRAWBERRY, a small tomato of a pleasant strawberry flavor, excellent for preserving like plums, with the addition of a little lemon juice; the RED CHERRY, YELLOW CHERRY, and YELLOW PLUM.

**Turnips.**—It will be found convenient to grow a few turnips in every farm garden. The culture should be the same as that already recommended for growing this crop in the field. (See Vol. I, page 358.)

**Garden Herbs and their Cultivation.**—A few of the most useful herbs, such as those for flavoring soups and meats, and for medicinal purposes, etc., should be found in every garden. They require but little care and room, and are a great convenience, some kinds being a necessity in every household. Some are perennial, and when once obtained, may be preserved for years with but slight attention. Sow the seeds as early in the spring as the ground will admit, in shallow drills, a foot or more apart, according to the room required for the plants to grow, and when a few inches high thin out or transplant. They should be harvested at the proper time, which is on a dry day, just before they come into blossom. They should then be quickly dried in the cool shade, and packed in dry boxes or other receptacles, excluding them from the air as much as possible, as exposure to it causes them to lose much of their strength.

The principal garden herbs are HOARHOUND, LAVENDER, SAFFRON, SAGE, SUMMER SAVORY, SWEET MARJORAM, WORMWOOD, and THYME. CARAWAY, DILL, and FENNEL are also desirable garden plants, and may be cultivated with but slight attention. Of those mentioned, caraway, fennel, hoarhound, lavender, sage, and wormwood are perennial. In localities where the winters are very severe the fennel roots will be liable to freeze, and should be taken up carefully and put in a cool cellar with moist earth packed around the roots, to prevent them from drying up. Set out early in the spring, in rich, deep soil.

**Sage** is the most important of the garden herbs. The seed may be sown in drills from fifteen to twenty inches apart, in a warm, rich, and finely pulverized soil, and covered about an inch deep. Thin out, if too thick, when the plants are a few inches high, or transplant. Keep out the weeds by frequent hoeings. They are perennial plants, consequently will live through the winter, if the ground is rather dry. Every spring the plants should be taken up, separated, and reset in a freshly prepared bed. The stems should be cut just before blossoming, and spread in the cool shade to dry. If seed is desired, permit a few of the strongest and most thrifty plants to blossom for that purpose. The seeds will be black when fully ripe.

**Gardening for Farmers' Wives and Daughters.**—Although farmers' wives and daughters are generally busily occupied with household duties a large portion of the time, and therefore do not lack for exercise in this respect,—in fact, too many of them are overworked and have but little leisure,—still, the majority of them could not only find healthful but pleasant occupation by spending a few moments each day in out-door exercise, and nothing is better for this purpose than gardening. American women, as a rule, are much behind their English sisters in respect to out-door exercise, and consequently have less constitutional vigor. Much can be done by the farmers' wives and daughters in not only having a plenty of beautiful flowers and delicious fruits continuously during the entire season, but nice vegetables also, while there will be found much more pleasure in this employment and

no small amount of profit in robust health and vigor, as well as in the material products of such labor.

A recent writer says: "I know a lady whose sensible doctor told her, twenty years ago, that she was half gone with consumption, and that her only chance of life was to be in the open air as much as possible. She accordingly commenced cultivating her garden, and a perfect bower of paradise was her little yard. Was the soil poor, she enriched it. Were her varieties indifferent, she procured better. Nearly all the flowers were fragrant. Fifteen kinds of roses bloomed under her hands, and a succession of flowers filled out the summer. One side of the yard was covered with grapes. Peaches, plums, and raspberries were trained *en espalier*, and choice squashes ripened on the roofs of the outhouses. Tomatoes were trained to single poles and yielded luxuriantly; and ruby strawberries peeped out even from the bleaching grass. She herself was as fresh and vigorous as you could expect one to be whose half-decayed lung had left her with insufficient vitality; but her life was saved, and it has been a happiness to herself and a blessing to others. She is right, too, when she says that more than half the credit for the ornamentation of our dooryards and homes is due to the ladies who urge the men to do their duty in this respect."

# PART VI.

# BEES AND THEIR MANAGEMENT.

IN all ages of the world's history, honey bees have been held in high esteem, and honey as an article of food regarded as a luxury. Aside from the sweet product which they manufacture, there will ever be much interest associated with the study of the peculiar habits and wonderful instincts of these little insects; hence, bee-keeping, as a pursuit, is one of the most attractive of employments, and when properly managed, is also very profitable. Any farmer could keep a few swarms of bees, sufficient to furnish a good supply of honey for home use, and these would require but very little care; but it is quite essential that this attention be given at the proper time. By a little forethought, however, this can be so managed as not to interfere with the regular occupation. To be a successful apiarist and conduct the business on an extensive scale, requires close observation, patient and persistent effort, and promptness to do whatever is necessary to be done without delay. It would be well for the apiarist to commence with a few swarms at first in order to acquire familiarity with the business by actual work and observation among them; he should also be aided by the most authentic writers on the subject, and thus acquire all the practical information possible. His colonies will soon rapidly increase, even without any other additions, and he will find it a paying as well as interesting and pleasant employment.

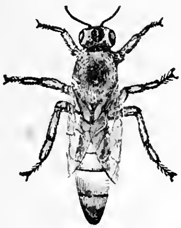
**Natural History of Bees.**—The honey bee belongs to the order *Hexapods*, or true insects, and the sub-order *Hymenoptera*, which includes wasps, etc., such insects as have a tongue for taking liquid food and strong jaws for biting. The honey bee belongs to the family *Apidæ* which comprises all insects that feed their larvæ on pollen and honey. The larva of the bee is a footless, maggot-like grub, which is fed on honey and pollen. It has been ascertained that the egg which would otherwise produce a working bee, may be changed during its growth by the workers, when necessary, to a queen. This is done by feeding with a peculiar kind of food which seems to be more stimulating than that fed to the ordinary bees. The mother bee or queen, lays all the eggs from which the colony is hatched, her eggs producing workers, commonly called "neuters," drones or males, and queens.

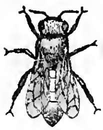
She lives several years, but the working bees do not survive more than one year, and the males are destroyed at the end of the first summer's growth. The queen bee, unlike most insects, deposits eggs ten or eleven months during the year in temperate climates; although in a climate where the winters are very severe, the season of depositing eggs would be somewhat shorter. When the eggs are about to hatch, the bees seek industriously for that kind of nourishment suitable for the food of the larvæ. This consists of pollen, with a proportion of honey and water that has been perfectly digested in the stomachs of the bees. The egg is hatched, when kept in a proper temperature, in about three days, and the larva, which resembles a small white worm, lies coiled up in the bottom of the cell. The bees feed it with the greatest care. In the course of five or six days it has attained its full size, and nearly fills the cell in which it is confined. It now ceases to eat, and the bees close up the cell with a covering of wax-like substance. For the next thirty-six hours the larva is busily engaged spinning its cocoon, and in three days more it enters the pupa state. It is now white, and the head, wings, legs, and every other part of the future bee may be distinguished through its transparent cocoon. In the course of seven or eight days it tears or bursts its covering, and emerges from its cell a perfectly formed bee. This is all accomplished in twenty-one days after the egg is deposited in the cell by the queen mother, or twenty-five days after the time the eggs were laid. The drones or males, however, require four days longer. As soon as the young bee is thus emancipated from its cell, its guardians or nurses gather around it, caressing it with their tongues and giving it all the food it will eat. They then clean out the cell it has vacated, except leaving untouched a great portion of cocoon or web, which serves to bind the sides of the comb more firmly together. When it quits the cell, the young bee is light gray in color. For several days afterwards, frequently a week or two, the working bees occupy themselves inside the hive mostly, and will not be seen flying about much, they being busily employed as nurses to the young hatched bees.

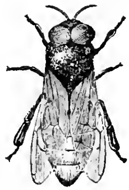
Every swarm or colony of bees is composed of three different kinds, which constitute, to all appearance, that number of different modifications of sex, viz.: the queen, the workers, and the drones.

**The Queen Bee.**—The queen is the only perfectly-developed female in the hive, and is consequently the mother bee of the colony, although she was called the king by Virgil, Pliny, and also many other writers as late as the last century.

In the propagating season she is constantly employed in laying eggs, the number averaging from one thousand to two thousand per day. Berlepsch once possessed a queen bee that laid 3,021 eggs in twenty-four hours by actual count, and in twenty days had deposited 57,000. This bee continued prolific five years, and must have laid during that time, at a low estimate, more than a million eggs. By such energetic measures, on the part of the queen, the colonies are kept populous. But this instance ranks somewhat above the average, both in the number of eggs laid and the age to which the queen retains possession of her full powers, the usual age to which she remains thus useful being about three years, although it is not uncommon for a queen to live to the age of four or five years, the period depending largely upon the natural vigor of the stock. In respect to longevity the queen differs widely from the others of her colony, none of the drones and workers surviving through the year. She is easily distinguished from the others by her larger size and greater length, the abdomen being quite long in proportion to the remainder of the body, while the wings are relatively shorter than those of either the workers or drones, and reach only a little more than half the length of the abdomen. Her mandibles are weaker than those of the workers, and her tongue or ligula, as well as the labial palpi and maxillæ, are considerably shorter. Her eyes, like those of the working bee, are smaller than those of the drone.


QUEEN BEE.


WORKER.


DRONE.

She is provided with a sting, like the workers, although it is much longer, and resembles that of the bumble-bee in being curved. Like that of the latter also and the wasp, it has but few projections pointing backward like the barb of a fish-hook, which prevent its withdrawal when it is once fairly inserted. The sting of the workers has seven prominent barbs on each side, while there are three on those of the queen. There is generally but one perfect queen existing at one time in each hive, and she seems to be treated by all the others with marked affection and deference. If an extra queen should be introduced into a hive already supplied, the two rivals would meet in mortal combat and fight until one was killed; the survivor would then be received as the accepted sovereign of the hive.

There is so much jealousy displayed by the queen of the hive towards others of the sex that, when the pupa of a future queen is sufficiently developed to emerge from its imprisoned cell, it is often prevented from so doing by a guard who hold their royal prisoner in bondage until after the queen mother has left the hive to conduct a swarm forth, thus removing all danger. In order to prevent the young queen from escaping her cell in such time of danger, the workers sometimes strengthen it with an additional covering of wax, perforating it with a small opening, through which she can thrust out her tongue to be fed by those that

guard her, and keep the queen mother at a distance. She constantly utters a kind of plaintive, piping cry, that can be readily distinguished from the other sounds of the hive, and which often seems to be answered by the mother queen, who will endeavor to get at the cell and destroy her if possible, by stinging. This the workers seem to understand, and whenever there is a prospect of a swarm being about to issue from the hive, they will concentrate about the royal cells, and prevent the old queen from getting near them, even beating and fighting her off, if she endeavors to get too near. But when the swarming time is over, or the circumstances are such that there is no prospect of another swarm being sent out during the season, the bees will not take measures to prevent the old queen from appeasing her wrath and jealousy in the destruction of her prospective rivals, which she accomplishes without mercy, with her poisonous sting, until one after another, the inmate of every royal cell is lifeless.

After the old queen has taken her departure with the first swarm, the young unhatched queens are permitted by those that guard their cells to emerge at intervals of a few days in order to prevent their meeting and destroying one another, as they would do at once if the opportunity presented, for a young queen as soon as hatched, seems to be anxious to get rid of every rival, and will not only endeavor to kill any other queen in the hive, but will even attack the cells of the royal unhatched brood in the same manner as an old queen, if not prevented by the bees that guard them. When the season for swarming is passed, the vigilance ceases in a great measure, and if two queens should happen to emerge at the same time, and meet in deadly conflict, it is said by those who have studied closely the habits of these insects, that instead of seeming to prevent the battles, the other bees appear to excite these combatants to renewed attacks against each other, and will surround and bring them back to the contest if they show any disposition to retreat or recede from each other, and when either of the queens shows an inclination to approach her antagonist, all the bees forming about them instantly give place to allow her sufficient room for the attack; also that the first use which the victorious queen makes of her power, is to destroy all her future rivals in their cells, while the other bees which are spectators to the scene, share in the spoil by greedily devouring any food which may be found about the pupae, and will even turn cannibals by sucking the fluids from the bodies of these unhatched queens before they drag them out of the cells. The life of a queen is from two to four years, the most prolific period being the first two years. A young queen is more liable to produce a working progeny, and an old one drones.

**Working Bees.** — The workers were formerly supposed to be of the neuter gender, and are commonly called neuters; but it has become a fully established fact that they are undeveloped female bees, and are hatched from the same kind of eggs or larvæ that the queens are, these eggs being capable of producing either a queen or worker, according to circumstances, the quality of the food, size of cell, etc., making the difference. These workers perform all the labor of gathering honey, bee glue, pollen, secreting wax from honey, constructing combs for honey and cells for hatching the young, feeding the young bees when hatched, keeping the hive clean by carrying out the offal and their dead companions, as well as keeping guard and combating any intruding enemy that may venture near.

**Average Life of Working Bees.** — The working bees live only a few weeks, so that a hive is repeatedly renewed from the hatching of the eggs of the queen. These little insects live from sixty to ninety days. In winter, when they are dormant, the time does not count, and one of the objects in breeding is of course to lessen the time between the fall and the spring, or to secure as early spring broods as possible.

A Western apiarist gives the result of his experiment to ascertain the length of time bees live during the working season, thus: "I had a stand of the little black bees of the genuine stingers, and on the morning of May 30th I killed the queen, and by carefully looking through their hive I found one black drone, and destroyed that in the evening of the same day. I put in a cell for a yellow queen on the 2d of June. She was hatched out, and there were a few yellow bees in the hive on the 30th, in just twenty-one days from the time her first eggs were deposited. On July 7th a few yellow bees were to be seen playing around the hive; and on the 13th day of July, just fourteen days from the time the yellow bees were hatched out, a few were seen at work with the black bees. Now any one can see that if the yellow bees hatched out in twenty-one days, the last black bees were all out by the 20th of June; and if the yellow bees went to work on the 12th of July, the last of the black bees must have gone to work on the 4th of July, making fourteen days from the time they were

hatched, unless one will go to work sooner than the other. This stand contained nothing but black bees when the black queen was destroyed, and on the 18th of July, just forty-nine days from the time the black queen was destroyed, there was not a black bee to be seen about the hive. I opened it. Not one was to be seen inside. Now I know that the bees will live longer at any other season of the year, and thought this would be a good chance to test the height of the working season. The hive was examined every day during the whole time, so that no mistake might be made."

**Prolific Workers, etc.** — A few prolific workers are occasionally seen in a hive, but this circumstance is rare, and is accounted for by Huber from such having passed their larva state in cells contiguous to the royal cells, or those from which the queen bees were hatched, and that they may at some early period have eaten a portion of the jelly that was the especial food of the royal brood, their ovaries thus receiving a partial development. This accounts for the production of eggs in a hive that is destitute of a queen — a circumstance that sometimes occurs, and which is thus readily explained. Such eggs as are hatched from workers always produce drones. The number of workers in a hive will range from 1,500 to 4,000 or more, a good, strong colony generally averaging about 3,500 in number.

**Drones.** — The drones are the male bees of the hive, and seem to have no other duty except that of impregnating the queen once, thus rendering a large portion of her eggs fertile during her life. This impregnation takes place in the air — never in the hive — the drone being at the time always mutilated, falls to the ground, and dies. Huber states that the probable reason for so large a number of drones in every hive is the necessity of the aërial impregnation, and that there may be a sufficient opportunity of the queen meeting some one of the number when she makes her aërial flight for this purpose. After the impregnation of the queen takes place, she returns to the hive, which she never leaves again except with a young swarm; the workers then destroy all the drones in the hive, and carry from it every dead body that remains after the conflict. They even destroy, at the same time, all the male eggs and larvæ, tearing open the cocoons for this purpose. This usually occurs in June, July, or August. When, however, a hive is deprived of its queen, the drones are permitted to live frequently through the winter. After getting rid of the drones, which consumed a large portion of their provisions, the working bees busily employ themselves in collecting a supply of honey and pollen for winter use, they seeming to realize that the feeding of the useless mouths of the lazy drones was attended with more needless expense than advantage to the bee public. The usual number of drones in a hive is from 200 to 300, but it is quite safe for the bee keeper to leave less than half that number to insure the impregnation of the young queens. An unimpregnated queen will lay eggs producing all drones, but after impregnation she can lay eggs that will produce either working bees or drones, seemingly at will, although various theories are entertained respecting the real cause of this phenomenon.

**Varieties of Bees.** — The domestic honey bee (*Apis mellifica*) is supposed to be a native of the Eastern Hemisphere, although it is now found in nearly all parts of North America. It was not, however, known here until introduced from that source. It is easy to see how readily this insect would escape domestication, and rapidly spread throughout the entire continent by the natural process of swarming. The honey bee is doubtless modified more or less by the climate of the regions where carried, yet how far this modification may be extended remains an unsolved problem. If, as is the case with domesticated animals, important modifications may be secured, and a honey bee produced that shall not only possess qualities of prolificacy and vigor even beyond what we now have, but also with such an increased length of tongue as to reach to the hitherto sealed sweets of the red clover, the possibilities of the honey harvest would be doubled. The varieties of the honey bee best known are the Black or German, the Italian or Ligurian, the Cyprian, and the Syrian.

**The Black or German Bee.** — This variety, as well as the Italian, was known in the time of Aristotle, 400 years before Christ. It was introduced into this country at an early period of its history, is of medium size, and about the same color throughout — that of a grayish black.

**The Italian** variety is so called from the fact that the first importation of it was from Italy. When pure-bred it is distinguished by three bright yellow bands at the base of the abdomen. When mixed with other varieties, these bands are not generally very pronounced. The principal characteristic of this breed is mildness of disposition and great vigor; hence they are easy of management, and will protect their hives from robbing-bees

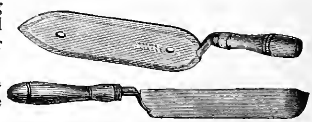
and the bee moth with great energy. They are so gentle that, after a little experience, any one can handle them without fear of being stung. They breed faster, and, being larger than the common or German variety, have longer tongues, which enable them to reach to the honey deposit of certain flowers not reached by the latter; they will, therefore, gather much more honey during the season than the common variety. Mr. W. S. Blaisdell, of Randolph, Vt., a successful and extensive apiarist for many years, says: "The Italian bee has become very generally known, and the leading apiarists have pronounced very emphatically as to its superiority over the common variety. These bees adhere with great tenacity to their combs, and go with much reluctance into the surplus boxes, especially when these boxes are not at the nearest possible point to their brood. In this respect they are unlike the blacks, and those who have been successful with the latter are not always careful to note this disinclination of the Italian, and, careless of what their instinct demands, fail to reap the benefits of their superior capacity."

ITALIAN BEE.

**The Cyprian** variety, from the island of Cyprus, and the SYRIAN, from the mountains of Lebanon, resemble the Italian very closely, being marked quite distinctly with the yellow bands. They differ from the Italian in disposition, especially the Cyprian, being of strong, nervous temperament, and apt to be very combative in disposition when disturbed. They are, however, more prolific in late fall breeding than the German or Italian, furnishing a stronger colony of young bees to endure the winter. They have a swifter flight and longer tongues than the German or common black variety, and also seek the surplus boxes fully as readily as the latter. Hybrid bees are apt to be cross and vicious in disposition.

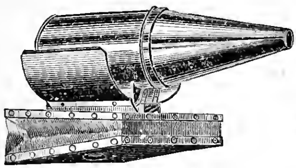
BEE VEIL.

**Implements Essential for the Apiary.**—In bee-keeping, as in any other business, certain implements are essential. The first requisite in the apiary is a good hive, and the very best should be secured. A bee-feeder is also a necessity for every hive; one should be procured that does not drip, and which can be filled without disturbing the bees. A bee-veil will be found of great convenience for the novice in the business in handling the bees in swarming time, etc., but the apiarist of long experience will scarcely require this protection. A honey knife for taking the honey from the hive is also very essential, although any well-tempered, thin knife will answer the purpose. Where honey is made in small, movable frames, the honey knife is not essential.

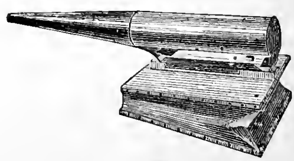


HONEY KNIVES.

A good bee-smoker is a very serviceable implement, and is really a necessity where bees are kept on an extensive scale. These implements are used for subduing bees by fumigation, when necessary to handle them or to remove their honey from the hive; also for causing parts of different swarms to unite when desired. A few puffs of smoke from any of the modern bee-smokers will quiet and subdue the most angry and combative swarm of bees in a few moments, so that they may be manipulated at will without danger to the operator.



BINGHAM'S BEE-SMOKER.



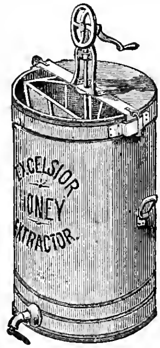
NEW BELLOWS SMOKER.

Bingham's Bee-Smoker, manufactured by A. H. Newman, Chicago, Ill., has extra wide shields for protecting the hands and bellows from heat, and obviates the danger of burning

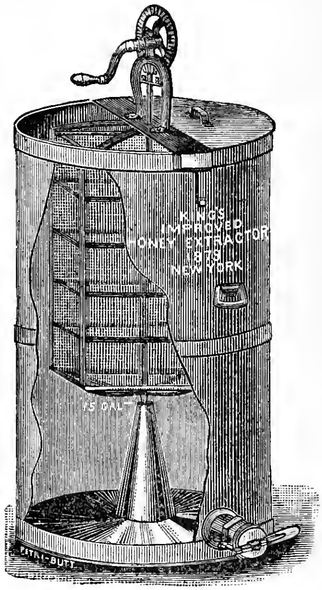
the fingers. The New Bellows Smoker, made by A. J. King & Co., New York, is one of the largest implements of this kind, consequently will burn a long time. There is no solder about it; consequently no melting or loosening of the joints. The ventilator is self-acting, and so constructed as to prevent all back suction; consequently no fire or ashes can get into the bellows A honey extractor is an implement more essential to the professional bee-keeper than the farmer, and will be necessary only where a large number of colonies of bees is kept.

There are centrifugal machines for extracting the honey from the comb, which may be done in such a manner as not to injure the latter, which may be returned to the hive for future use, thus saving much time and labor for the bees in comb-making.

A foundation mill or press for making foundation comb is kept for use by some extensive apiarists, but these are somewhat expensive, and the foundation purchase of the comb itself will cost but little more than the value of the wax.




EXCELSIOR HONEY EXTRACTOR.



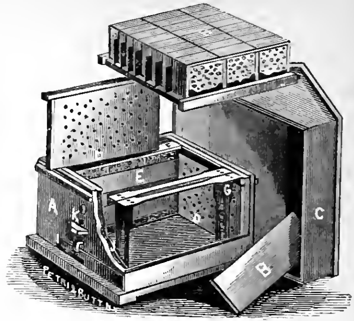
KING'S HONEY EXTRACTOR.

**Hives.**—The old-fashioned close box hive has long been discarded by the most successful bee-keepers, and the more commodious and improved hives have taken its place, while the match and the brimstone are becoming only a relict of discarded and barbarous practices. It is interesting to note the different kinds of hives used by certain nations. In Cyprus hives are made of mud in the shape of a cone, the inhabitants having no improved inventions. In Palestine bees are frequently kept in a water jug, the bees going in and out of the neck. In Jerusalem the traveler frequently sees hives made in the form of a conical bullet. In Lebanon and Mount Hermon they are made about three feet long and plastered with clay. In Damascus and on the desert they are made of clay (unburnt) in the form of a cylinder.

A hive is the home of the bee, and certain essentials are requisite to render it suited to the best results from the colony that inhabits it, which consist of its adaptation to the storage of honey, and the health and comfort of the colony. It should be so arranged that it may be suitably ventilated, and yet kept at a proper temperature. It must be clean, or no bee will inhabit it; it must also be properly adapted to a changeable climate, and made to be comfortable in a climate where the winters are severe, or the bees will be liable to freeze. The hives should contain movable frames, and should be closely jointed and carefully put together.

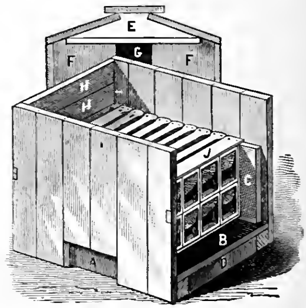
The hive should also afford every facility for constructing the combs and rearing the young broods, and admit of every part of the combs being occasionally inspected, and of their being removed when necessary. Especially should the home of the bees afford protection against moisture and the extremes of heat and cold, as well as sudden vicissitudes of temperature, since the latter will prove very injurious to the most hardy and well stocked colony.

The following cut illustrates the improved Chaff Eclectic hive. A represents the main body of the hive of which the front and back are double-walled, the inner walls J being very thin, and thickly perforated with small holes. The four inch space between the walls is occupied by two sheets of moth-proof carpet lining, leaving a space of three inches between the sheets, which, filled with chaff, serves to keep the bees warm and also absorbs and carries off the moisture generated by the swarm. D is a close-fitting division board or follower, of which there are two. These dividers are formed by covering both sides of close-fitting frames with moth-proof carpet lining overlaid with perforated veneering in the same manner as the front and rear wall of the hive. When these are in place the breeding apartment of the hive is double walled throughout, and the inner wall presents an entire surface perforated with small holes leading direct to the absorbing material, and so the hive is rendered dry and warm in the severest weather. It is manufactured by A. J. King & Co., of New York.

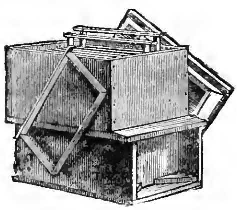



CHAFF ECLECTIC HIVE.

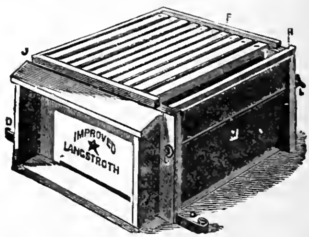
The Nellis Chaff hive, made by Houck & Peet, of Canajoharie, New York, is similar in some respects to the latter, yet differing very materially in others. It has facilities for accommodating two or more colonies at one time, if desired, and can be packed with chaff in winter to secure protection against the cold. The cut shows one end of the hive, also one follower removed. Either end can be removed in an instant when convenience requires it. Resting on the pieces C, seventeen brood frames can be put in the main hive, either for extracting honey or accommodating two colonies. Loose following boards by a simple device, are secured against the brood frames, thus making the brood chamber adjustable at any point. By means of a division board and entrance at both sides at A, two colonies can be quickly and comfortably accommodated. Broad frames of boxes can be set at the sides and all closed up by the followers. The spaces over the frames gives a large room for top storing. The bottom between A and D is double




THE NELLIS CHAFF HIVE.



LANGSTROTH HIVE.




IMPROVED LANGSTROTH HIVE.

walled and can be packed with chaff or other material. The walls at C are 1¾ inches thick, so that colonies packed at two sides, bottom and top, are well protected against cold. Or if desired, the brood frames can be turned half-way around and thus chaff can be packed on all sides

The Langstroth hives consist of a series of movable frames for comb, so arranged that any one of them may be separately removed without disturbing the others.

Fig. 1 shows an extra story, as used on the Langstroth hives, with one of the seven cases raised, bringing to view the three boxes with the tin separator at the back, which is

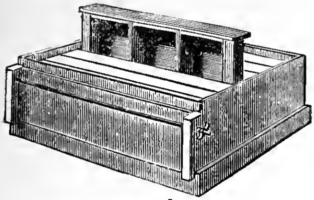


FIG. 1.

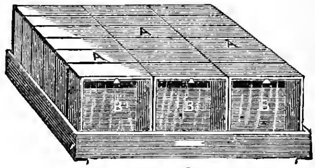
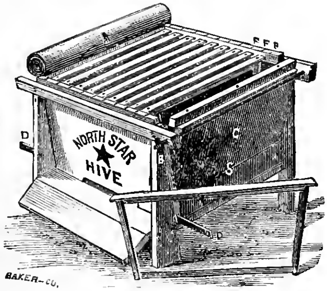
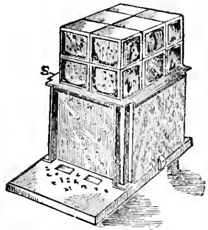


FIG. 2.

fastened to the case. Figure 2 represents the comb honey rack used in three hives, containing eighteen boxes, with the wedge to tighten or loosen the boxes as desired for manipulation. The Langstroth hives, and those represented in the following cuts, manufactured by A. H. Newman, of Chicago, Ill., have long been in use, and are quite popular among apiarists.



NORTH STAR HIVE.


WORRALL'S CENTENNIAL HIVE.

The North Star Hive is similar to the Improved Langstroth, as will be seen by the accompanying cut. Worrall's Centennial is an observatory hive with four glass sides and an iron frame. The Circular Hive, invented and manufactured by W. S. Blaisdell, of Randolph, Vt., has an adaptation of movable comb frames to the circular form of the brood chamber. Fig. 1 represents the front view of the hive, the opposite side being precisely the same. The two entrances, with the use of a suitable division board, admit of two hives being made from one. Fig. 2 represents the interior of the hive with the walls removed. Some of the exterior walls are made in sections, as may be desired, so that different parts will turn on hinges, thus permitting access to the interior arrangements without their removal.

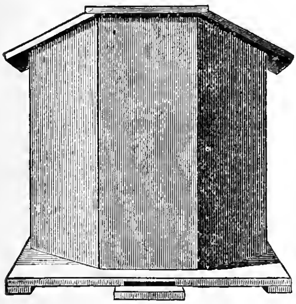
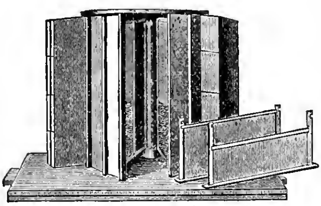


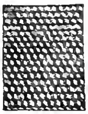
FIG. 1.

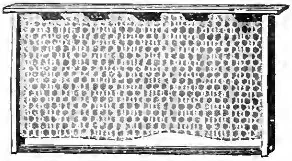

CIRCULAR HIVE. FIG. 2.

**Location of the Apiary.**—With respect to the location of the apiary, a few general principles should be observed; these are briefly given by Mr. Alonzo Bradley of Massachusetts, as follows: "In selecting a place for an apiary, if there are not too many objections, locate it where the issuing of swarms can be both seen and

heard from the house, and where thieves will be shy in approaching. It is important to have it protected from the winds by a building or tight board fence. If no such place can be obtained, then posts set in the ground, with boards nailed on, will answer the purpose. The stands for the hives should be six inches or more from the ground, and have a short piece of board, making an inclined plane from the alighting board of the hive to the ground; the reason for doing this is, that during the early spring and late fall harvests of honey, the bees coming in heavily loaded on chilly days, and more especially quite late in the afternoon, in some degree relax their efforts as they near their hive. The result is, instead of alighting on the bottom board of their hive, they just fail in this, and but for the board, would pass directly under to the ground, become chilled, and unable to take wing again."

**Comb Foundation.** — Great advantage is derived from the use of the comb foundation, as well as that of old comb from which the honey has been extracted, since it has been estimated by repeated experiments that bees make from fifteen to twenty pounds of honey in the same time required to make one pound of comb. The comb foundation is made from beeswax rolled out in sheets about three-sixteenths of an inch thick, and passed through a double set of rollers in order to receive the exact number of indentations of cells to the square inch, and in the same form that the natural comb has. By fastening it into the honey or brood frames as a base for the bees to build up their cells upon, much labor and time is saved them in preparing, while the comb may be ready for use in a few days, that would otherwise require months to complete, time which ought to be devoted to the making of honey. The bees build these cells out to the full size required in from one to five days, and fill them with honey, or the queen deposits her eggs when necessary. When it is desired to raise drones, a larger cell is required than for the workers, and the indentations are accordingly made larger on some foundations than others for this purpose. Another advantage gained is in always having straight combs, which is not always the case when the bees make their own comb. The wired comb foundation has flat-bottomed cells, made thin and even, the wire being incorporated into it for the purpose of making it strong and to preventi ts sagging. It is used only in the brood chambers. The comb foundation may be temporarily held in place, after a little cutting and fitting, with wire, wooden pegs, or other temporary fastenings, as the bees will attach it securely to the box in a few days.


COMB FOUNDATION.


WIRED COMB FOUNDATION.

**Summer Management of Bees.** — The following methods of bee management have been prepared expressly for this work by an experienced apiarist, W. S. Blaisdell, of Vermont, to whom previous reference has been made: Early in the summer, two courses present themselves to the bee keeper. One of them is to run his colonies for increase in numbers; the other is to work them mainly for the production of honey. In the increase of colonies we again meet with two methods, which is either by natural or artificial swarming. As early as the limits of the hive are reached, and its whole capacity is filled with honey or brood, the bees will start queen cells preparatory to a division of the hive. The queen deposits eggs in these, as well as in other cells.

**Swarming.** — In ten or twelve days after the egg is laid in the royal cell, the young queen is so far matured that she utters a cry. When the young queen is killed by the old queen, her rival, swarming is delayed for awhile; but in case the bees interfere to prevent it, placing themselves as a wall around the threatened cell, the old queen collects her party, and, at the earliest favorable moment of the weather, follows them in leaving the hive. The swarm circles high in the air, and after a short time forms in a cluster in some place probably selected by the queen, the bees forming around her in solid mass. From this cluster several leaders at once issue to select a suitable place for their final destination, usually seeking a hollow tree in the forest. The cluster remains until these leaders return, be the time longer or shorter, when the entire swarm instantly rises and sweeps in a straight line to the selected spot. During this delay in the cluster, the swarm can be secured and hived; and when removed a rod or more from the place of lighting, the leaders in their return will never find them to lead them away. The best way to hive a swarm is the handiest, which may be one

of several to be entertained only in view of the situation, and which experience must teach. Such swarming of bees, being attended with so much uncertainty and sometimes loss, other methods are resorted to for increasing the stock. In some cases the queen fails to fly, and falls to the ground. She creeps back again into the hive, and the swarm is sure to follow. The bees never leave for any length of time without their queen, and if, when swarming, the queen can be captured, the bees will seek her. In order to prevent loss, it is the practice of some to clip the queen's wings on one side two-thirds of their length from the tip. This prevents her flight, and, with other management, some make it successful in securing the swarms. Care should be taken never to seize the queen by the body, for it may render her valueless, but she should always be grasped by the wings.

In eight days after swarming, another swarm will issue, since much of the brood has then hatched, unless, as is done by many, the precaution of removing all the remaining queen cells be done on the fourth or fifth day after the first swarming. The eggs are so far advanced that the bees after such time cannot construct cells therefrom for a new crop of queens A young queen is then given them, which is readily received. Many practice this method, which usually satisfies the swarming propensity of the bees that is often difficult to control, and no inconsiderable surplus is often obtained from the old stand, as well as the new one. It depends much upon the skill of the operator, and the method he is most used to, for his best success It should be remarked here that after the second swarm takes place no regularity is observed by others that may follow; several queen cells maturing about the same time, each queen may follow a depleted mass, and so greatly weaken the hive and prevent profitable gains. The proper time for bees to swarm is as early in the season as practicable, May being regarded as the best month, a July swarm not being considered of much value. It is a noticeable fact that first swarms generally alight near home; hence their queens can accompany them without much fatigue; and that swarms with young, unfertilized queens often settle at a greater distance from the hive; also, that second swarms are less particular to have the weather fine and sunny at the time of swarming.

**Artificial Swarming.** — This is the division of the hive into two or more parts, seeing that each part has late eggs from which the bees can rear queens. In doing this work, the new hive is usually put on the old stand, while the original colony is removed some distance away. Where some distance is not observed, the old bees will be apt to return to the spot, and so greatly deplete the working capacity of the older hive. The bees of the hive which does not contain the old queen will proceed to construct queen cells around some worker eggs. They will form from two to several of these cells, and in the usual length of time a new queen will issue. Her very first work will be to turn about and dispatch all the remaining queen cells, after which her flight is taken for fertilization; and so within twenty-five days after the egg was laid, she herself will be busy laying eggs. From the fact that during these twenty-five days the bees of the hive are mostly idle, with no filling up of the combs with eggs for the supply of working progeny, the practice prevails of furnishing a queen at once to the new hive, thereby gaining valuable time and a hive full of brood. By the time that otherwise the new queen would be only beginning her work among depleted workers, the queen so introduced would have brood already hatching and more coming on every day. Bee keepers are coming to understand that where they have not themselves the facility or skill to rear queens profitably, they are worth to them all that is asked, and much more, from this start of twenty-five days in the height of the summer's work.

There are many modifications of the artificial method of swarming or creating colonies, which will readily suggest themselves to the man who attempts the business. Where increase of stock is desirable, the larger number of colonies can be produced by this method, particularly when young queens are at once introduced. Where the purpose is to produce the largest amount of honey, the practice is to prevent swarming. The secret of success in honey production is to have heavy colonies for work at harvest time. One large colony will gather more product than several weak ones.

This branch of the business is acknowledged to be the most difficult, requiring the most skill and work in order to be successful. Most colonies having young queens, and with right manipulation, may be controlled; but there will be, even under favorable conditions, some exceptions. Hives will get into a swarming fever at times which no expedient can remedy. The best success, however, is had when several particulars of practice are observed. Among them may be mentioned the maintaining of young queens in the hive, or such as are not over two years of age, only in exceptional cases; to see that early and sufficient room be accessible for the deposit of surplus honey; to examine every week each colony in the most thorough

manner, and secure the removal of all queen cells; and to see that the hive has facilities for good air in very high temperatures, in fact at all times, but more especially during the days of greatest heat.

**Hiving New Swarms.** — To the novice in bee keeping, there is always more or less dread attended with working about bees, especially in hiving a new swarm, but to an experienced apiarist, the handling of bees for any purpose is a very simple matter. Whenever working about bees for any purpose whatever, there should be no sudden movements, no haste or excitement of any kind; if there is, the person will be liable to be stung, as the bees would become aroused and excited by such movements. Be careful not to crush a single bee, or allow one to get injured by being in any part of the clothing, as the odor would excite the whole swarm. The same is true if the person handling the bees gets stung, as bees are very susceptible to odors, and the whole colony would be thus rendered combative. There is little or no danger if the person handling them is quiet and slow in movements, and careful in each of these particulars.

When so unfortunate as to be stung, the best method of procedure is to get out of the way as quickly and in as quiet a manner as possible. Bees seem to have a natural dislike towards some persons, while they permit others to work about the hives and handle them freely, without the least appearance of displeasure. The odor of perspiration is much stronger with some people than others, and this is probably the reason of the dislike manifested by bees towards some individuals. When a person feels timid about handling bees, it may be well to secure a protection against danger by wearing a bee veil tied over the face, and tucked in around the neck and coat in such a manner as to prevent the bees from getting underneath, as shown in a previous cut. Mosquito netting, or any other thin substance that will keep the bees out, and permit a person to see through, will answer the purpose. The pants may be tied down securely over the boots, and the hands protected by a pair of long skin gauntlets tied securely over the coat cuffs. The hive should be prepared beforehand and ready for use; be sure it is clean, that is, free from all dust, dirt, or other offending substance.

When the bees settle on a low bush, as they frequently do, shake carefully as possible into the hive as many of the swarm as possible, cover and leave it near where the bees can enter. Sometimes the limb may require cutting or sawing off for this purpose; if so, do it carefully without shaking the mass of the bees more than necessary. If a large portion of the swarm falls upon the ground in attempting to get them into the hive, they may be helped to enter by carefully sweeping them towards the entrance with something soft, such as a soft brush, a bush in full leaf, etc. As soon as they begin to enter, the whole swarm will be sure to follow soon; they will therefore reqnire no further attention until evening, when the hive should be placed where it is to remain permanently. When a swarm settles upon the limb of a tree so high that it is impossible to reach it by a ladder, it may be gently brought down by having a rope tied around it before sawing it off, the end of the rope being passed over a limb somewhat higher to ease its descent as an assistant upon the ground holds the end of the rope and regulates the velocity of its descent. During the swarming season, bees should be watched; by so doing, a swarm will seldom be lost.

**Wintering Bees.** — Great losses have been sustained in apiaries at the North from the mortality occasioned by severe winters. By proper care, risks can however be obviated or greatly lessened. At the present time the advocates of wintering bees on their summer stands, and those in favor of wintering in cellars, are about equal. Probably neither method will be wholly followed. Each has its advantages and disadvantages. Strong colonies with ample stores will probably come forth stronger and hardier in the spring where wintered on outside stands, properly protected in chaff hives, than if kept in the cellar. Bees in cellars consume less food, and the method may very advantageously be practiced where the colonies are weak and have light stores. More care can be shown them in the cellars. Very careful precautions, however, should be observed in preparing the cellar, and in watching its ventilation throughout the winter. The bees should be put in before the coldest weather sets in, and when the hives are perfectly dry. This last caution is *very essential.*

The cellar should be made perfectly dark, and the hives should be so arranged that the light from the lamp when going into it will not strike the entrance. It should be kept as nearly as possible at a temperature of 45°. The hives should be placed on a rack raised two feet from the cellar bottom. The honey board should be moved to uncover about one-half inch along the upper edge of the brood chamber. Rows may be piled one above the other, to rest on slats laid across the lower row of hives. Preference, however, is to be had for the

independence of each row, so that examination may be made when any particular hive requires it. A good method is to raise the honey board, and place narrow slats across the frames, and then place these on a warm quilt or cloth, which will absorb moisture and allow some ventilation. The entrance of the hives should not be closed, but left as for summer work. If rats and mice abound, cats should be employed to rid the cellar of them, but the entrances must not be closed on any account.

The ventilation of the cellar must be carefully attended to. Besides the regular means used for the purpose, as the weather moderates towards spring, the windows of the cellar should be opened after dark at evening and then closed before it is light in the morning. A good bee-house for wintering the whole stock is the best, but the cost of such would be an objection with many. The odor of a hive is the best indication of its healthfulness. Where it is at all bad, give more ventilation and resort to feeding. Bees should not be taken from their cellar quarters until the weather is somewhat settled, and there is no danger of chilling the young brood. Otherwise spring dwindling will be very apt to be the result, and this is one of the serious dangers to be apprehended and guarded against.

Bees are frequently wintered upon their summer stands, but in a cold climate they require some protection during severe winters. A simple shed for bees makes a good stand for both summer and winter, and is not expensive. It should be made with a waterproof roof, tight on the closed sides, facing the South or East, which should be open in summer, but have shutters placed in front in winter to keep out the snow. In order to have bees winter well, certain conditions are essential, which may be comprised with having the bees healthy, with plenty of young bees reared in the fall, a good supply of good honey, — at least thirty pounds in the fall for an average-sized colony in a place accessible to them, — a warm hive which will retain heat but pass off all excess of moisture and admit of ventilation, and the exclusion of snow and rain. The principal thing in summer is to avoid extreme heat, and in winter extreme cold, wet, and snow. By providing a good shed or bee-house, these may be avoided. Bees that are strong and healthy and have a good supply of honey, will endure considerable cold without freezing.

**Introducing a New Queen.** — It sometime happens that from the loss of the queen or mother bee, or other reasons, it is desirable to supply a swarm with a new queen. Various methods are resorted to for doing this, and even with the utmost care, a valuable queen will sometimes be lost. A method that will usually be attended with success is to let the new queen go on a comb of honey; then place a round wire-cloth thimble or cage about an inch and a half in diameter over her: press the thimble into the comb firmly; from the under side of the comb cut a hole through to the cage, leaving the cuttings in the opening thus made, and press the comb down around the entrance of the hole, so as to cause the bees considerable labor before reaching the queen. By this means the bees will generally glady welcome her. It is best never to liberate a queen, but to leave her so that the bees will have to do it themselves after a few hours. A queen should never be released from a cage of any kind while the bees evince any undue anxiety to cover the surface of the cage, or while they seem excited or nervous. The German method of introducing a queen is to remove the hive four or five feet to the front and facing the old stand, putting an empty duplicate hive in its place; then shake the bees off the combs on the ground between the two hives, and replace the frames as quickly as possible in the hives on the old stand; daub the queen with honey and drop her between the combs. Some place her at the entrance of the hive and let her go in with the other bees; others sprinkle the mass of bees on the ground quite freely with sweetened water, then place the queen daubed with honey among them and let all go in together. The objection to this method is the time consumed, and the risk attending it. If the colony has been queenless a long time, or there are no young bees of the proper age for nursing the young larvæ, a frame of hatching bees should be put in with the queen, as field bees are quite averse to working as nurses during the honey-getting season.

**Stimulative Feeding.**—Bees are very active in time of brood rearing while there is a supply of sweets from without. Where no artificial means are used, the bees delay active brood rearing until the flowers come. And since it takes nearly a month from the egg until the young bees are ready for work, the apiarist will be troubled with weak and dying colonies in June, with no force at the best to take advantage of the earliest honey harvest, unless he understands how to strengthen his colonies. He can easily do it by judicious feeding. For this purpose a small feeder holding about one pound of food so made as not to permit any escape of heat from the hive, should be placed on the top and filled with thin syrup. This syrup can be made of two parts of granulated sugar, and one part of water, heated and

boiled for a few minutes. A thinner syrup can be made, if the spring is cold and flights for water are sought to be obviated. Only a few pounds—say, from five to ten to a hive—need be fed, but a little thus fed in April and May, and the reward in increased strength and labor of the bees will be out of all proportion to the outlay. At the same time a little unbolted rye flour should be furnished as a substitute for pollen in a protected, sunny place for the bees, before they begin to gather pollen from the early blossoms.

The same practice of stimulating by light feeding is advised preparatory for winter. Where the hive is already full of honey, some combs should be extracted, or, if one has no apparatus for doing it, a few combs should be removed and a few empty ones put in their places. The feed at this season should be made into thick syrup, and where granulation may occur, a spoonful of vinegar will obviate it; or to be more exact, vinegar can be used in proportion to one gill to eight or ten pounds of sugar. This feeding may also be in small quantity, from three to five pounds in all, or it may be more; the bees never waste. A feeding like this during ten days in October will give a nice full hive of young bees for winter, and insure a vigorous colony in the spring. Never feed at any time, and at this time particularly, what you do not know to be absolutely *pure*. Glucose, or any proportion of it in the food will be sure to cause the death of the bees from the poison it contains.

**Removing Honey from Hives.**—Before commencing to work around a hive, it is best to be sure that the bees are filled with honey. At the first alarm of any kind, such as smoking them with pipe, or bee smoker, tapping on the hive, etc., the bees will at once fill themselves with honey, it seeming to be a natural instinct to prepare themselves for any emergency. After feeding about five minutes they will generally be quiet, and are then very easily managed, rarely ever stinging, unless injured, or unnecessarily disturbed. Where no bellows is had for the purpose, a little smoke from a pipe will answer the purpose quite well. Remove the honey quietly, paying no attention to the bees. If the comb sticks, loosen or cut it with a knife. Honey knives made especially for this purpose are the best. When boxes or frames are used, which are the best, simply remove the frame when the comb is filled with honey and sealed over, and supply the place with empty ones.

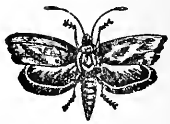
**Honey-Bearing Plants.**—It must be remembered that the bee is not a producer, but a gatherer of stores, and the vegetable world must furnish the material from which honey is to be gathered by these little industrious workers. But bees cannot gather honey where there is none to be had within easy range, nor can a colony keep itself in a proper condition to take advantage of an abundance of autumn blooming plants, when there is not an accessible supply of spring and summer blossoms to encourage brood rearing and to keep the colony strong. No farmer or stock-breeder would think of attaining success in keeping and rearing animals without providing them with food, and yet how few bee-keepers provide bee pasturage for their bees, by sowing such plants as have honey-producing blossoms. Many colonies of bees might be yearly saved from starvation, and tons of honey put upon the market, if more attention were paid towards securing a continuous pasturage for bees to work in, from early spring until late autumn. Some locations may be better adapted to certain kinds of plants than others, but there will be found a sufficient variety suited to different sections for this purpose. Where only a few colonies of bees are kept, there will generally be a sufficient supply of flowers for the bees to work upon, without any extra care in this respect, but where bee-keeping is followed as a special business, the supply of honey-bearing plants must be considered in order to make it a success. Among the clovers the Alsike, White, and Melilot or Sweet Clover are noted for their honey-producing qualities. The latter has no particular agricultural value. The plants bloom in June and July. The bass wood is also excellent for bee pasturage, while the apple, and other fruit trees, the locust, the raspberry, and blackberry, are exceedingly valuable.

The nectar of the common red clover is located beyond the reach of our honey bees, and it is the prevalent opinion among apiarists that could we obtain an improved breed of bees that had tongues sufficiently long to utilize the blossoms of this plant, our honey production would be largely increased. The dandelion and strawberry are among the earliest blooming plants, at a time when the honey forage is scarce, and consequently a trying one for bees. During May and June the Sumac and White Sage are very abundant in some sections, especially in California, while at the South, which is one of the very best regions for bee culture, owing to its climate and wealth of flowers, the cotton plant furnishes an abundant source of honey supply from June until the frost comes. In the autumn the Wild Aster, Golden Rod, and Buckwheat are a prolific source of honey, but the products made from these blossoms have a deep color, and a peculiar flavor which discounts them in the market. Surplus boxes are

usually removed early in August so that the white quality gathered may not be tainted with these later products. The number of honey-bearing wild flowers is very large, while many of the forest trees, such as the varieties of Maples, Aspens, Linden, Willow, etc., are valuable for this purpose. The practice is prevailing in some sections for bee-keepers to cultivate such plants as are known to yield honey. Alsike Clover, Sweet Clover, White Clover, and Giant Mignonette are among the best, together with others not so prominent. A few acres of these will pay large returns in keeping up a fine bloom, producing the choicest quality of nectar until frost comes.

Pliny states that the practice of removing bees from place to place, in order to keep them supplied with good pasturage, was common in the Roman territory; he says: "As soon as the spring food for bees has failed in the villages near our towns, the hives of bees are put into boats and carried up against the stream of the river in the night, in search of pasture. The bees go out in the morning in quest of provisions, and return regularly to their hives in the boats, with the stores they have collected. This method is continued till the sinking of the boats to a certain depth in the water shows that the hives are sufficiently full; and they are then carried back to their former homes, where their honey is taken out of them." This custom is still in practice in Italy, France, and Egypt, floating barges of bees being frequently seen in the river Po, the Nile, and many of the rivers in France. This practice has been tested to a certain extent on the lower Mississippi, with good results, and when properly conducted would doubtless prove a very remunerative enterprise.

**Enemies and Diseases of Bees.**—Bees have many enemies, among which may be mentioned the wasp, hornet, the bee-killer (*Asilus*), a two-winged fly which seizes the bee and sucks its fluid, spiders which sometimes entangle them in their nests, ants which sometimes prove troublesome in the hive, the king-bird, woodpecker, swallow, sparrow, rats, mice, lizards, toads, etc. But the worst enemy to bees is the moth, two species of which (*Galleria mellonella* and *Achroia grisella*) find their way into the hive, where they deposit their eggs on the comb in such vast numbers that the hive is soon filled with the larvæ, which spin their webs and destroy the comb to such an extent that the bees are forced to leave the hive. The female moth is considerably larger than the male, and is in color a silver gray. As long as a colony of bees is strong and in good condition, it is safe from these worms, but if weakened by overswarming, loss of queen, or in any other way, the moth is pretty sure to make depredations on the hive, and fill it with larvæ. There can really be no perfectly moth proof hive, as the moth finds entrance where the bees do. and in order to be perfectly moth proof, a hive must exclude the bees also. A trap for the moths can be made of a mixture of vinegar and water well sweetened and placed towards evening in white dishes among the hives, in which many of the moths will be drowned. Worms may also be caught early in the season, by laying pieces of shingles down upon the bottom board. The worms will retreat under these for a sheltered place to spin their cocoons, and must be destroyed once or twice a week. The moth is less troublesome in large apiaries than small, as the former have better care and management, and the colonies are kept in a more vigorous and thrifty condition.



BEE MOTH.

A good authority on this subject, Mr. Hutchin, of Farlinville, Kansas, recommends the following method: "The sprightly little wren, if encouraged to build its nest near the hives, will destroy myriads of worms and insects. They are easily attracted, by putting up boxes made three inches square, with an inch and a half hole for an entrance."

The following method will frequently prove effectual in destroying the moth: Set a pan of grease or oil in a tub of water; light it and set it in the apiary, and keep it burning all night. The light attracts the miller, which flits around it and either perishes in the flame or is drowned in the water. Various other means may be employed for the destruction of the bee moth, and moth traps of various styles have been invented, but they are apt to be neglected, and, unless properly attended to, and emptied once or twice a week, they become moth nurseries instead of traps, and aid in breeding this pest.

Bees are subject to but few diseases, but these are sometimes very fatal. The dysentery occasionally makes great havoc in a hive, and is generally caused by neglect of sanitary conditions, by close confinement, dampness, lack of ventilation, by their being forced into undue excitement in cold weather, improper food, etc. This disease is indicated by the appearance of the excrement within the hive, which the bees, when in a healthy state, are particularly

careful to entirely exclude. The disease known as "foul brood" is the most fatal of all to bees, and is very contagious, the infection frequently remaining in the hives, comb, and honey for a long time after the bees are exterminated. Dysentery is a disease confined to the perfectly grown insects, but foul brood is confined to the larvæ, which, when grown near to maturity. die and putrefy after being sealed over by the bees. The brood become brown, and give off an offensive odor that can easily be detected in any hive, while the working bees seem wholly unable to remove this foul mass that remains to spread contagion to other broods and other hives. This disease is supposed to be caused by the presence of spores of a microscopical fungus (*micrococcus*), and when it once gets into an apiary, is very apt to carry destruction with it, since the young brood, dying off at such a rate, will soon cause a general decline in the colonies. The spores get into the honey, and the bees, eating it and feeding it to the larvæ, infect them generally. The following remedy is said to be successful in eradicating this disease: eight grains salicylic acid, eight grains soda borax, one ounce of soft water; mix thoroughly, uncap all the brood, and throw a solution over the comb with a spraying machine.

**Keeping and Marketing Honey.**—Some cap honey will not crystalize under any conditions, while again, honey that seems to be of equally good quality will crystalize in a short time. The best means of preventing crystalization is to keep it in a dark, dry, and warm room, especially the latter. A honey-room for storing honey should be had in connection with every large apiary. Mr. G. M. Doolittle of Borodino, N. Y., an extensive apiarist of many years experience, gives the following directions respecting the storing of honey and preparing for market:

"If possible, we want our honey room in the warmest part of the building occupied, so as to evaporate the honey that is in the few unsealed cells around the edges of the boxes next to the wood, in order that when we come to glass it, or get it ready for market, the honey will not run out and soil the combs or boxes. To this end we painted our shop a dark color, and located our honey room in the southwest corner, so that the rays of the afternoon sun would make it very warm. When we get a ton or so of honey in it, the temperature stands at nearly 90° day and night, as the honey holds the heat generated during the day, through the night. By leaving it thus for a month, we have our honey so we can tip it over just as we wish without leakage, and if after it gets to market it happens to be kept in a damp, cool room, it will be some time before it will take on moisture enough to affect the looks of the comb to any extent.

We are often asked the cause of honey oozing out of the cells. The cause is *dampness.* While in a large market in New York, not long since, we saw honey that had been kept in a damp, underground room so long that the sealing of the cells had burst, the honey had soured. and was leaking from the comb badly, while the odor from it was offensive. While speaking to the parties about it, they said they believed a cellar the best place to keep honey, but it needed little argument to convince them that they were wrong. Of course this high temperature will cause the moths to hatch soon, but they may be easily disposed of. In preparing the honey for market, which we commence to do by the middle of August, it must be glassed and crated. Have your crate by your side and the glass near you. First get the propolis out of the corners of the box, if there is any where the glass is to come; then bend up the little tins put in to hold the glass, drop in your glass, and bend down the tins. Now you can scratch off the propolis on the edges of the box without getting it on the honey. Scrape off clean so the box will look nice and tidy, and set in the crate.

In crating honey it is always proper to put the best side of the honey out, the same as wool is done up. We once knew a man to do up his wool with the dark or outside ends out, and he could hardly sell it at any price. Why? Not because the wool was not just as good, but because it did not look so well. Just so with a crate of honey. Market men want the best side out, but do not mistake and fill up the center of the crate with dark honey. Grade your honey and then put the best side of each lot out, but let your white honey be all No. 1 white.

When the crate is full put on the cover with bright, round-headed screws. This gives the crate a nice appearance, does not tend to break the honey like driving nails, and the cost is but a trifle. When crated, sand-paper off the sharp corners and top of the crate, and pack nicely away till ready to ship to market.

We have had much trouble in getting glass cut accurate enough to suit us, as they do not expect to cut very close at the factories, and if a glass is a little large it springs the box from the honey and sets it to leaking. For the past few years we have bought our glass cut

6 by 30 inches, and re-cut it the 5-inch way ourselves. We cut the same as in a mitre-box—that is, have a box fixed with regulating screws, so that you can cut the glass just exactly five inches every time. Have your cutting stick fastened to the box so the glass will go under it; shove up the screws and cut; leave a drop of two inches under, and touch the glass so as to break off where cut and drop down; shove up and cut again, breaking off as before. Thus you can cut very fast and be sure every glass is right.

Sell your honey, if possible, rather than ship on commission, for the returns rendered by the commission men are not always satisfactory. Always ship your honey in warm weather (the first half of September) if possible, as it will go much more safely than in cold weather. If you can sell your honey at home, do so, but the most of us cannot so dispose of a large quantity. If we prefer to have our buckwheat and fall honey stored in boxes, we leave them on the hive; otherwise it is best to take them off, for the bees daub them badly with propolis at this season of the year. A good way is to take off the boxes and put in frames in place of the side boxes, having them filled to store away for feeding purposes. Bees will build comb very fast in the body of the hive during a good buckwheat yield."

**Profits of Bee Keeping.**—Under proper management, bee-keeping is a very profitable bnsiness, as will be seen from the following testimony from some of the most successful apiarists of the country. Mr. G. M. Doolittle, the authority previously quoted, says:

"Commencing a certain season with sixty hives, I had a hundred colonies to go into winter quarters, having obtained in box honey 2,909 pounds, and 572 pounds of extracted, making 3,481 pounds in all, or 58 pounds per stock as an average yield. This is the lightest yield I have had during seven years, with the exception of one year when the average yield per colony was only 50 pounds. For the past seven years (and it is only by a number of years' experience in any business that a true result as regards the profit or loss can be obtained) the report of our apiary stands as follows: At the end of the first of the seven years' report, the average yield in honey was eighty pounds per colony; the second year, a fraction of a pound less than 100 pounds: the third, a little over 106 pounds; the fourth, 50 pounds; the fifth, a little less than 167 pounds; the sixth, just 71 pounds, and the seventh, 58 pounds, making an average yield for the past seven years of a little over 90 pounds per stock. Upon looking over my diary I ascertain that this honey has been sold at an average price of 21¼ cents per pound, the highest price being 28½ cents, and the lowest 10¾ cents. From past experience, I believe a thorough, practical man can do all the work required to be done with 100 colonies of bees, and judging from the above, he would obtain for an average term of years 9,000 pounds of honey annually, which, at 21¼ cents per pound, would bring him in a yearly income of $1,912.50."

Mr. D. A. Jones, the owner of one of the most extensive apiaries in the country, if not in the world, has his bee farm located near Beeton, Ontario, Canada, his four bee yards being situated at the angles of a square which embraces several square miles of country. During the current year Mr. Jones has already taken, at the last of July, 50,000 pounds of honey from 620 colonies of bees, and, judging from yields of previous years, calculated the total yield for the year to be 70,000 pounds, in which case the total net profit would be between $7,000 and $10,000.

Mr. W. L. Hutchinson, of Michigan, says: "There is no question in my mind that, if properly managed, there is money in bees, as during the four years that I have been engaged in the business I have never made less than $15 per swarm, clear profit, each season; this season realizing $25 per colony." Mr. J. G. Taylor of Austin, Texas, reports thus: "I commenced in the spring with seven colonies; up to June 20th I took 968 pounds of surplus honey, and increased to twenty good colonies."

Mr. J. F. Meyer of Wyandotte, Kansas, makes the following statement: "My market is at home, retailing at from 15c. to 17½c. per pound. My honey crop this year is 2,200 pounds from thirty full colonies. I sold in the spring twenty-five colonies."

We thus see that it is no uncommon occurrence for a colony of bees to produce seventy pounds of honey or more during a single season, when under proper management. In fact, a good strong colony of bees located in a region of country producing an average quantity of honey-producing flowers, will, with careful management, produce 100 pounds of surplus comb honey, and still allow another strong colony to be made from it. The extra colony will amply pay all expenses for the labor performed. This, with a fair price for honey, will net $20 to each colony. Much better results than this are frequently realized by our most successful bee keepers. An active man, who understands the business, should be able to attend to from one hundred to two hundred colonies.

## PART VII.

# VARIOUS TOPICS.

## SILK CULTURE.

THE precise period when silk was first used as a textile material is not known, but its history is one of great antiquity. It seems to have come into use after wool and linen, and is one of the early industries mentioned in history. Writers differ very materially in regard to the date of its origin, some placing it at 2700 and others 1700 B. C. The Chinese records state that the wife of Hoang-Ti, the third emperor of China, first tested the practicability of using the thread from the cocoons, and discovered the method of reeling the silk and of employing it to make garments. Silk is one of the most valuable of fabrics, and the producing of it has attracted much attention in all civilized countries where it may be produced. The importance of this industry, and the increased interest at present manifested in it in this country, together with the growing demand for the raw material, augurs favorably for its becoming more extended and permanently established here at a time not far distant, it now being in its infancy. The following on the habits of the silk worm, together with practical instructions relating to their rearing and general management, is extracted from the manual of Prof. C. V. Riley, one of the best authorities on this subject in this country, if not in the world:

**Characteristics and Different States or Stages of the Silk-Worm.** — The silk-worm, or that which supplies the ordinary silk of commerce, is the larva of a small moth known to scientific men as *Sericaria mori*. It is often popularly characterized as the Mulberry Silk-Worm. Its place among insects is with the *Lepidoptera*, or scaly-winged insects, family *Bombycidæ*, or spinners. There are several closely allied species, which spin silk of different qualities, none of which, however, unites strength and fineness in the same admirable proportions as does that of the mulberry species. The latter has, moreover, acquired many useful peculiarities during the long centuries of cultivation it has undergone. It has in fact become a true domesticated animal. The quality which man has endeavored to select in breeding this insect is, of course, silk-producing, and hence we find that, when we compare it with its wild relations, the cocoon is vastly disproportionate to the size of the worm which makes it or the moth that issues from it. Other peculiarities have incidentally appeared, and the great number of varieties or races of the silk-worm almost equals those of the domestic dog. The white color of the species, its seeming want of all desire to escape as long as it is kept supplied with leaves, and the loss of the power of flight on the part of the moth, are all undoubtedly the result of domestication. From these facts, and particularly from that of the great variation within specific limits to which the insect is subject, it will be evident to all that the following remarks upon the nature of the silk-worm must necessarily be very general in their character. The silk-worm exists in four states — egg, larva, chrysalis, and adult or imago — which we will briefly describe.

**The Egg.** — The egg of the silk-worm moth is called by silk raisers the "seed" It is nearly round, slightly flattened, and in size resembles a turnip seed. Its color when first deposited is yellow, and this color it retains if unimpregnated. If impregnated, however, it soon acquires a gray, slate, lilac, violet, or even dark green hue, according to variety or breed. It also becomes indented. When diseased, it assumes a still darker and dull tint. With some varieties it is fastened to the substance upon which it is deposited by a gummy secretion of the moth produced in the act of ovipositing. Other varieties, however, among which may be mentioned the Adrianople whites and the yellows from Nouka, in the Caucassus,

EAST INDIA SILK WORM.

have not this natural gum. As the hatching point approaches, the egg becomes lighter in color, which is due to the fact that its fluid contents become concentrated, as it were, into the central, forming worm, leaving an intervening space between it and the shell, which is semi-transparent. Just before hatching, the worm within becoming more active, a slight clicking sound is frequently heard, which is, however, common to the eggs of many other insects. After the worm has made its exit by gnawing a hole through one side of the shell, this last becomes quite white. Each female produces on an average from three to four hundred eggs, and one ounce of eggs contains about 40,000 individuals. It has been noticed that the color of the albuminous fluid of the egg corresponds to that of the cocoon, so that when the fluid is white the cocoon produced is also white, and when yellow the cocoon again corresponds.

**The Larva or Worm.**—The worm goes through from three to four moults or sicknesses, the latter being the normal number. The periods between these different moults are called "ages," there being five of these ages, including the first from the hatching and the last from the fourth moult to the spinning period. The time between each of these moults is usually divided as follows: The first period occupies from five to six days, the second but four or five days, the third about five, the fourth from five to six, and the fifth from eight to ten. These periods are not exact, but simply proportionate. The time from the hatching to the spinning of the cocoons may, and does vary all the way from thirty to forty days, depending upon the race of the worm, the quality of the food, mode of feeding, temperature, etc.; but the same relative proportion of time between moults usually holds true.

The color of the newly-hatched worm is black or dark gray, and it is covered with long, stiff hairs, which, upon close examination, will be found to spring from pale-colored tubercles. Different shades of dark gray will, however, be found among worms hatching from the same batch of eggs. The hairs and tubercles are not noticeable after the first moult, and the worm gradually gets lighter and lighter until, in the last age, it is of a cream-white color. When full grown, it presents the appearance as indicated in the cut. It never becomes entirely smooth, however, as there are short hairs along the sides, and very minute ones, not noticable with the unaided eye, all over the body.

The preparation for each moult requires from two to three days of fasting and rest, during which time the worm attaches itself firmly by the abdominal prolegs (the 8 non-articulated legs under the 6th, 7th, 8th, and 9th segments of the body, called prolegs in contradistinction to the 6 articulated true legs under the 1st, 2d, and 3d segments), and holds up the fore part of the body, and sometimes the tail. In the operation of moulting, the new head is first disengaged from the old skin, which is then gradnally worked back from segment to segment until entirely cast off. If the worm is feeble, or has met with any misfortune, the shriveled skin may remain on the end of the body, being held by the anal horn; in which case the individual usually perishes in the course of time. It has been usually estimated that the worm in its growth consumes its own weight of leaves every day it feeds; but this is only an approximation. Yet it is certain that during the last few days before commencing to spin, it consumes more than during the whole of its previous worm existence. It is a curious fact, first noticed by Quatrefages, that the color of the abdominal prolegs at this time corresponds with the color of the silk.

Having attained full growth, the worm is ready to spin up. It shrinks somewhat in size, voids most of the excrement remaining in the alimentary canal; acquires a clear, translucent, often pinkish or amber-colored hue; becomes restless; ceases to feed, and throws out silken threads. The silk is elaborated in a fluid condition in two long, slender, convoluted vessels, one upon each side of the alimentary canal. As these vessels approach the head, they become less convoluted and more slender, and finally unite within the spinneret, from which the silk issues in a glutinous state and apparently in a single thread. The glutinous liquid which combines the two, and which hardens immediately on exposure to the air, may, however, be dissolved in warm water. The worm usually consumes from three to five days in the construction of the cocoon, and then passes, in three days more, by a final moult, into the chrysalis state.

**The Cocoon.**—The cocoon consists of an outer lining of loose silk, known as "floss," which is used for carding, and is spun by the worm in first getting its bearings. The amount of this loose silk varies in different breeds. The inner cocoon is tough, strong, and compact, composed of a firm, continuous thread, which is, however, not wound in concentric circles as might be supposed, but irregularly, in short figure of eight loops, first in one place and then in another, so that in reeling several yards of silk may be taken off without the cocoon turn-

ing round. In form the cocoon is usually oval. and in color yellowish; but in both these features it varies greatly, being either pure silvery-white, cream or carneous, green, and even roseate, and very often constricted in the middle. It has always been considered possible to distinguish the sex of the contained insect from the general shape of the cocoon, those containing males being slender, depressed in the middle, and pointed at both ends, while the female cocoons are of a larger size and rounder form, and resemble in shape a hen's egg with equal ends.

**The Chrysalis.** — The chrysalis is a brown, oval body, considerably less in size than the full-grown worm. In the external integument may be traced folds corresponding with the abdominal rings, the wings folded over the breast, the antennæ, and the eyes of the inclosed insect — the future moth. At the posterior end of the chrysalis, pushed closely up to the wall of the cocoon, is the last larval skin, compressed into a dry wad of wrinkled integument. The chrysalis state continues for from two to three weeks, when the skin bursts and the moth emerges.

**The Moth.** — With no jaws, and confined within the narrow space of the cocoon, the moth finds some difficulty in escaping. For this purpose it is provided, in two glands near the obsolete mouth, with a strongly alkaline liquid secretion, with which it moistens the end of the cocoon and dissolves the hard, gummy lining. Then, by a forward and backward motion, the prisoner, with crimped and damp wings, gradually forces its way out, and when once out the wings soon expand and dry. The silken threads are simply pushed aside, but enough of them get broken in the process to render the cocoons from which the moths escape comparatively useless for reeling. The moth is of a cream color, with more or less distinct brownish markings across the wings. The males have broader antennæ or feelers than the females, and may by this feature at once be distinguished. Neither sex flies, but the male is more active than the female. They couple soon after issuing, and in a short time the female begins depositing her eggs, whether they have been impregnated or not. Very rarely the unimpregnated egg has been observed to develop.

**Varieties or Races.** — Domestication has had the effect of producing numerous varieties of the silk-worm, every different climate into which it has been carried having produced some changes in the quality of the silk, or the shape or color of the cocoons, or else altered the habits of the worm.

Some varieties produce but one brood in a year, no matter how the eggs are manipulated; such are known as *Annuals*. Others, known as *Bivoltins*, hatch twice in the course of the year; the first time, as with the Annuals, in April or May, and the second eight or ten days after the eggs are laid by the first brood. The eggs of the second brood only are kept for the next year's crop, as those of the first brood always either hatch or die soon after being laid. The *Trevoltins* produce three annual generations. There are also *Quadrivoltins*, and, in Bengal, a variety known as *Dacey*, which is said to produce eight generations in the course of a year. Some varieties moult but three times instead of four, especially in warm countries and with Trevoltins. Experiments, taking into consideration the size of the cocoon, quality of silk, time occupied, hardiness, quantity of leaves required, etc., have proved the annuals to be more profitable than any of the polyvoltins, although Bivoltins are often reared; and Mr. Alfred Brewster, of San Gabriel, Cal., says that he found a green Japanese variety of these last more hardy than the Chinese Annuals. Varieties are also known by the color of the cocoons they produce, as greens, or whites, or yellows, and also by the country in which they flourish. The white silk is the most valuable in commerce, but the races producing yellow, cream-colored, or flesh colored cocoons are generally considered to be the most vigorous. No classification of varieties can be attempted, as individuals of the same breed exported to a dozen different localities would, in all probability, soon present a dozen varieties. The three most marked and noted European varieties are the Milanese (Italian) breed, producing small yellow cocoons; the Ardèche (French), producing large yellow cocoons; and the Brousse (Turkish), producing large white cocoons of the best quality in Europe. Owing to the fearful prevalence of *pébrine* among the French and Italian races for fifteen or twenty years back, the Japanese Annuals have come into favor. The eggs are bought at Yokohama in September, and shipped during the winter. There are two principal varieties in use, the one producing white and the other greenish cocoons, and known respectively as the white Japanese and the green Japanese Annuals. These cocoons are by no means large, but the pods are solid and firm, and yield an abundance of silk. They are about of a size, and both varieties are almost always constricted in the middle. Another valuable race is the white

Chinese Annual, which much resembles the white Japanese, but is not as generally constricted.

**Wintering and Hatching the Eggs.** — We have already seen the importance of getting healthy eggs, free from hereditary disease, and of good and valuable races. There is little danger of premature hatching until December. but from that time on the eggs should be kept in a cool, dry room in tin boxes to prevent the ravages of rats and mice. They are most safely stored in a dry cellar, where the temperature rarely sinks below the freezing point, and they should be occasionally looked at to make sure that they are not affected by mold. If, at any time, mold be perceived upon them, it should be at once rubbed or brushed off, and the atmosphere made drier. If the tin boxes be perforated on two sides. and the perforations covered with fine wire gauze, the chances of injury will be reduced to a minimum.

The eggs may also, whether on cards or loose,* be tied up in small bags and hung to the ceiling of the cold room. The string of the bag should be passed through a bottle neck or a piece of tin to prevent injury from rats and mice. The temperature should never be allowed to rise above 40° F., but may be allowed to sink below freezing point without injury. Indeed, eggs sent from one country to another are usually packed in ice. They should be kept at a low temperature until the mulberry leaves are well started in the spring, and great care must be taken as the weather grows warmer to prevent hatching before their food is ready for them, since both the mulberry and osage orange are rather late in leaving out. One great object should be, in fact, to have them all kept back, as the tendency in our climate is to premature hatching. Another object should be to have them hatch uniformly, and this is best attained by keeping together those laid at one and the same time, and by wintering them. as already recommended, in cellars that are cool enough to prevent any embryonic development. They should then, as soon as the leaves of their food-plant have commenced to put forth, be placed in trays and brought into a well-aired room, where the temperature averages about 75° F. If they have been wintered adhering to the cloth on which they were laid, all that is necessary to do is to spread this same cloth over the bottom of a tray. If, on the contrary, they have been wintered in the loose condition, they must be uniformly sifted or spread over sheets of cloth or paper. The temperature should be kept uniform. and a small stove in the hatching room will prove very valuable in providing this uniformity. The heat of the room may be increased about 20° each day, and if the eggs have been well kept back during the winter they will begin to hatch under such treatment on the fifth or sixth day. By no means must the eggs be exposed to the sun's rays, which would kill them in a very short time. As the time of hatching approaches, the eggs grow lighter in color, and then the atmosphere must be kept moist artificially by sprinkling the floor, or otherwise, in order to enable the worms to eat through the egg shell more easily. They also appear fresher and more vigorous with due amount of moisture.

**Feeding and Rearing the Worms.** — The room in which the rearing is to be done should be so arranged that it can be thoroughly and easily ventilated, and warmed if desirable. A northeast exposure is the best, and buildings erected for the express purpose should, of course, combine these requisites. If but few worms are to be reared, all the operations can be performed in trays upon tables, but in large establishments the room is arranged with deep and numerous shelves, from 4 to 8 feet deep and 2 feet 6 inches apart. All wood, however, should be well seasoned, as green wood seems to be injurious to the health of the worms. When the eggs are about to hatch, mosquito netting or perforated paper should be laid over them lightly. Upon this can be evenly spread freshly-plucked leaves or buds. The worms will rise through the meshes of the net or the holes in the paper and cluster upon the leaves, when the whole net can easily be moved. In this moving, paper has the advantage over the netting, in that it is stiffer and does not lump the worms together in the middle. They may now be spread upon the shelves or trays, care being taken to give them plenty of space. as they grow rapidly. Each day's hatching should be kept separate. in order that the worms may be of a uniform size. and go through their different moultings or sicknesses with regularity and uniformity; and all eggs not hatched after the fourth day from the appearance of the first should be thrown away, as they will be found to contain inferior, weakly, or sickly worms. It is calculated that one ounce of eggs of a good race will produce 100 pounds of fresh cocoons; while for every additional ounce the percentage is reduced if the worms are all raised together, until for 20 ounces the average does not exceed 25 pounds of cocoons per ounce.

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*For explanation, see what follows under egg-laying.

The young worms may be removed from place to place by means of a small camel's hair brush, but should be handled as little as possible. The best mode of feeding and caring for them is by continuing the use of the feeding net first mentioned. As the worms increase in size the net must have larger meshes, and, if it should be used every time fresh food is furnished, it will save a large amount of time and care. It entirely obviates the necessity of handling the worms, and enables the person having charge of them to keep them thoroughly clean; for, while they pass up through the net to take their fresh food, their excrement drops through it and is always taken up with the old litter beneath. It also acts as a detective of disease; for such worms as are injured, feeble, or sickly usually fail to mount through the meshes, and should be carried off and destroyed with the refuse in the old net below. This placing on of the new net and carrying away of the old is such a great convenience and time-saver that in France, for many years, paper stamped by machinery with holes of different sizes, suited to the different stages of the worms, has been used. The paper has the advantage of cheapness and stiffness, but a discussion as to the best material is unnecessary here, the aim being to enforce the principle of the progressive rise of the worms. Details will suggest themselves to the operator.

Where the nets are not used, there is an advantage in feeding the worms upon leaf-covered twigs and branches, because these last allow a free passage of air, and the leaves keep fresh a longer time than when plucked. In this feeding with branches consists the whole secret of the California system, so much praised and advocated by M. L. Prevost. The proper stamped paper not being easily obtained in this country, mosquito netting will be found a very fair substitute while the worms are young, and when they are larger I have found thin slats of some non-resinous and well-seasoned wood, tacked in parallel lines to a frame just large enough to set in the trays, very serviceable and convenient; small square blocks of similar wood being used at the corners of the tray to support the frame while the worms are passing up through it. Coarse twine netting stretched over a similar frame will answer the same purpose, but wire netting is less useful, as the worms dislike the smooth metal.

Many rules have been laid down as to regularity of feeding, and much stress has been put upon it by some writers, most advising four meals a day at regular intervals, while a given number of meals between moults has also been urged; but such definite rules are of but little avail, as so much depends upon circumstances and conditions. The food should, in fact, be renewed whenever the leaves have been devoured, or whenever they have become in the least dry, which, of course, takes place much quicker when young and tender than when mature. This also is an objection to the use of the hashed leaves, as, of course, they would dry very quickly. The worms eat most freely early in the morning and late at night, and it would be well to renew the leaves abundantly between five and six A. M., and between ten and eleven P. M. One or two additional meals should be given during the day, according as the worms may seem to need them. Great care should be taken to pick the leaves for the early morning meal the evening before, as when picked and fed with the dew upon them they are more apt to induce disease. Indeed, the rule should be laid down, never feed wet or damp leaves to your worms. In case they are picked during a rain, they should be thoroughly dried before being fed; and on the approach of a storm it is always well to lay in a stock, which should be kept from heating by occasional stirring. Care should also be taken to spread the leaves evenly, so that all may feed alike. During this first and most delicate age the worm requires much care and watching.

As the fifth or sixth day approaches, signs of the first moult begin to be noticed. The worm begins to lose appetite and grow more shiny, and soon the dark spot already described appears above the head. Feeding should now cease, and the shelves or trays should be made as clean as possible. Some will undoubtedly undergo the shedding of the skin much more easily and quickly than others, but no feed should be given to these forward individuals until nearly all have completed the moult. This serves to keep the batch together, and the first ones will wait one or even two days without injury from want of food. It is, however, unnecessary to wait for all, as there will always be some few which remain sick after the great majority have cast their skins. These should either be set aside and kept separate, or destroyed, as they are usually the most feeble and most inclined to disease; otherwise, the batch will grow more and more irregular in their moultings and the diseased worms will contaminate the healthy ones. It is really doubtful whether the silk raised from these weak individuals will pay for the trouble of rearing them separately, and it will be better perhaps to destroy them. The importance of keeping each batch together, and of causing the worms to moult simultaneously, cannot be too much insisted upon as a means of saving time.

As soon as the great majority have moulted they should be copiously fed, and, as they grow very rapidly after each moult, and as they must always be allowed plenty of room, it will probably become necessary to divide the batch, and this is readily done at any meal by removing the net when about half the worms have risen and replacing it by an additional one. The space allotted to each batch should, of course, be increased proportionately with the growth of the worms. The same precautions should be observed in the three succeeding moults as in this first one.

As regards the temperature of the rearing-room, great care should be taken to avoid all sudden changes from warm to cold, or *vice versa*. A mean temperature of 75° or 80° F. will usually bring the worms to the spinning-point in the course of thirty-five days after hatching, but the rapidity of development depends upon a variety of other causes, such as quality of leaf, race of worm, etc. If it can be prevented, the temperature should not be permitted to rise very much above 80°, and it is for this reason that a room with a northern or north-eastern exposure was recommended as preferable to any other. The air should be kept pure all of the time, and arrangements should be made to secure a good circulation. Great care should be taken to guard against the incursions of ants and other predaceous insects, which would make sad havoc among the worms were they allowed an entrance; and all through the existence of the insect, from the egg to the moth, rats and mice are on the watch for a chance to get at them, and are to be feared almost as much as any other enemy the silk-worm has.

The second and third casting of the skin takes place with but little more difficulty than the first, but the fourth is more laborious, and the worms not only take more time in undergoing it, but more often perish in the act. At this moult it is perhaps better to give the more forward individuals a light feed as soon as they have completed the change, inasmuch as it is the last moult and but little is to be gained by the retardation, whereas it is important to feed them all that they will eat, since much of the nutriment given during the last age goes for the elaboration of the silk. At each successive moult the color of the worm has been gradually whitening, until it is now of a decided cream color. Some breeds, however, remain dark, and occasionally there is an individual with zebra-like markings. During these last few days the worms require the greatest care and attention. All excrement and litter must be often removed, and the sickly and diseased ones watched for and removed from the rest. The quantity of leaves which they devour in this fifth age is something enormous, and the feeding will keep the attendant busily employed.

Summed up, the requisites to successful silk-worm raising are: 1. Uniformity of age in the individuals of the same tray, so as to insure their moulting simultaneously. 2. No intermission in the supply of fresh food, except during the moulting periods. 3. Plenty of room so that the worms may not too closely crowd each other. 4. Fresh air and as uniform temperature as possible. 5. Cleanliness. The last three are particularly necessary during the fourth and fifth ages. While small, the frass, dung, and detritus dry rapidly, and may (though they should not) be left for several days in a tray with impunity, but he who allows his trays to go uncleaned for more than a day during the ages mentioned will suffer in the disease and mortality of his worms just as they are reaching the spinning-point.

**Preparation for Spinning.**—With eight or ten days of busy feeding, after the last moult, the worms, as we have learned before, will begin to lose appetite, shrink in size, become restless, and throw out silk, and the arches for the spinning of the cocoons must now be prepared. These can be made of twigs of different trees, two or three feet long, set up upon the shelves over the worms, and made to interlock in the form of an arch above them. Interlace these twigs with broom corn, hemlock, or other well-dried brush. The feet of each arch should be only about a foot apart. The temperature of the room should now be kept above 80°, as the silk does not flow so freely in a cool atmosphere. The worms will immediately mount into the branches and commence to spin their cocoons. They will not all, however, at the same time, and those which are more tardy should be fed often, but in small quantities at a time, in order to economize the leaves, as almost every moment some few will quit and mount. There will always be a few which altogether fail to mount, and prefer to spin in their trays. It is best, therefore, after the bulk have mounted, to remove the trays and lay brush carefully over them. The fact that the worms already mounted make a final discharge of soft and semi-fluid excrement before beginning to spin makes this separation necessary, as otherwise the cocoons of the lower ones would be badly soiled. As the worms begin to spin they should be carefully watched, to guard against two or three of them making what is called a double or treble cocoon, which would be unfit for reeling purposes. Whenever one worm is about to spin up too near another, it should be carefully removed to another part of the

arch. In two or three days the spinning will have been completed, and in six or seven the chrysalis will be formed.

**Gathering the Cocoons.** — Eight days from the time the spinning commenced it will be time to gather the cocoons. The arches should be carefully taken apart, and the spotted or stained cocoons first removed and laid aside. Care should be taken not to stain the clean ones with the black fluids of such worms as may have died and become putrid, for there are always a few of these in every cocoonery. The outer cocoons of loose or floss silk are then torn from the inner cocoons or pods, and the latter separated according to color, weight, and firmness of texture; those which best resist pressure indicating that the worm has best accomplished its work. Too much care cannot be taken to remove the soft or imperfect cocoons, as if mixed with the firm ones they would be crushed, and soil the others with their contents. The very best of the firm cocoons are now to be chosen as seed for the next year, unless the raiser prefers buying his eggs to the trouble of caring for the moths and keeping the eggs through the winter. Eggs bought from large establishments are, however, apt to be untrustworthy, and it is well for all silk-raisers to provide their own seed. These cocoons should be chosen for their firmness, and the fineness and color of the silk, rather than for their size.

Mr. Crozier says: "If white, take them of the purest white, neither soft nor satin-like; if yellow, give the preference to the straw-colored, which are the most sought after; and, last, if they are the green of Japan, the greener they are, of a dark, sharp color, very glossy, the better is the quality of the thread. Discard the pale shades in the last breed." If there are any double or treble cocoons in the batch, of the right color, quality, and consistency, they should be used before the others, as they are just as good for breeding purposes, though unfit for reeling. In estimating the quantity that will be required, the following figures will be of use: The general estimate is always made of 40,000 eggs to the ounce, and also that each female lays from 300 to 400 eggs. Taking the higher estimate, it will require only 100 females to lay an ounce of eggs; taking the lower, it will require 133. It will, therefore, not be safe to take fewer than 200 cocoons, half males and half females, if an ounce of seed is desired, and from that to 225 would be safer. While it may not always be possible to determine the sex of the cocoons by their shape, we may approximately separate them by weighing. The whole quantity set aside for breeding purposes is first weighed in order to get the average, and then each one is weighed separately, and all above the average may be pretty accurately considered females and all below it males. These breeding cocoons should now be either pasted upon card-board on their sides, or strung upon a string, great care being taken to run the needle through the silk only and not deep enough to injure the chrysalis, the object being in both cases to secure the cocoon so that the moth can the more readily make its escape. They can be laid aside in a rat-proof place to await the appearance of the moths, and in the meantime the other cocoons should be taken care of.

**Choking the Chrysalis.** — In most silk-producing countries the parties who raise the cocoons sell them to the reeling establishments before suffocation is necessary, as these establishments have better facilities for this work than are to be found in private families. If, however, the reeling is done by the raiser, or some time must elapse before the cocoons can be sent to a reeling establishment, some means must be used to kill the contained chrysalis before the cocoon is injured for reeling purposes by the egress of the moth. This can be done by stifling them with steam or choking them by dry heat. Steaming is the surest, quickest, and best method, if the facilities are at hand: it can be done at any steam mill. The cocoons are laid upon shelves in a tightly sealed box, and the steam is turned in. Twenty minutes will suffice to do the required work, and the cocoons are then dried in the sun. The dry heat method occupies a much longer time. The cocoons are placed in shallow baskets and slipped on iron drawers into an oven which is kept heated to a temperature of about 200° Fah. This should not be increased for fear of burning the silk. This operation lasts from two to twenty-four hours. A certain humming noise continues so long as there is any life, and its cessation is an indication that the chrysalides are all dead. Where the choking is well done there is little loss, only about one per cent. of the cocoons bursting at the ends. After choking in this manner, the cocoons should be strewn upon long wooden shelves, in the shade, with plenty of air, and, for the first few days, frequently stirred. After remaining on these shelves for about two months, with occasional stirrings, the chrysalides become quite dry and the cocoons will keep indefinitely.

**Egg Laying — Reproduction.** — In from twelve to twenty days from the time when the worm commenced to spin, the moths will begin to issue from the cocoons laid aside for

breeding purposes. They issue most abundantly during the early morning hours, from four to eight o'clock, and as they appear they should be taken by the wings and the sexes kept apart for a short time. The males may be readily distinguished from the females by their broader antennæ and smaller bodies, as also by the incessant fluttering of their wings. The females remain comparatively quiet, their abdomens being heavy and distended with eggs. A few hours after issuing, the sexes, in equal numbers, may be placed together, great care having been taken to destroy any that are at all deformed, in order to keep the breed as fine as possible. They should be placed upon paper or card-board, and the room should be kept as dark as possible in order that the males shall not uncouple themselves. For the complete impregnation of the eggs, the sexes should be kept together six hours, neither more nor less, and occasionally visited in order to replace those males which may have become separated. Should there, on this day, more males than females issue, the superfluous males may be put in a closed box and kept till the next day, when the state of things may be reversed. Should there, on the other hand, be a superfluity of females, a sufficient number of the strongest and most vigorous males should be uncoupled at four hours and placed with the unpaired females for six hours more. As the pairs are uncoupled at the end of six hours, care should be taken to injure neither sex. The female should be held by the wings with one hand and the abdomen of the male gently pressed with the other. The males may then be laid aside in a box, as there may be use for them before all the moths have appeared. After all the females are impregnated, however, their mates may be thrown away.

The females, as soon as separated, should be placed for a few minutes upon sheets of blotting-paper, where they will free themselves of a quantity of greenish-yellow fluid. From the blotting-paper they should be transferred to trays lined with cloth upon which the eggs are to be laid. This cloth should be of the smoothest sort of woollen stuff rather than of inen or paper, if it is desired to remove the eggs at a future time, as they will stick so fast o the latter that it will be difficult to remove without bruising them. Upon these trays they may be placed in rows, and will immediately commence depositing. It is advisable to tie up the trays at one end so that they incline a little, as the moths are then more apt to lay their eggs uniformly. They should also be kept in the dark, in accordance with the nocturnal habit of the moth. The temperature of the room should be kept at about 75°, and plenty of air given during oviposition. All of the thoroughly impregnated eggs will be laid in about twenty-four hours, and the moth should be removed after that length of time. She may continue depositing a short time longer, but the eggs should be kept by themselves and not mixed with the others. It will be well, also, if the best and purest breed be desired, to keep the eggs of those moths which were coupled with males that had been used before separated from the eggs laid by those which were coupled with virgin males. "The eggs are best preserved on the cloth where originally deposited, as they are protected by a natural coating of varnish, and, being fastened, the worms, when hatching, eat their way out better. For commercial purposes, however, they are usually detached during the winter by immersing the cloth containing them in cool soft water for a few moments; the moisture being then drained off by means of blotting-paper and the eggs gently removed with a paper-knife. They are then washed in soft water, thoroughly dried, and put away for keeping. All eggs which swim on the surface are considered bad and discarded. The Japanese producers sell their eggs on cards or cartoons made of coarse silk. The cards are placed in wooden frames, the rims of which are varnished, so that the moths — disliking the varnish — are made to confine their eggs upon the cards, which are consequently covered in a very regular and uniform manner."

**Reeling Silk from the Cocoons.** — If the mere rearing of the worm and the production of the cocoons is simple, the reeling of the silk is by no means so, as the greatest skill is required to accomplish the work properly, and the value of a hank of silk depends as much on the skill of the reeler as upon the quality of the original thread. In the best cocoons the silk will measure upwards of a thousand feet in length, and, though it appears single, it is in reality composed of two threads, which are glued together and covered as they issue from the spinneret of the moth with a glossy varnish, which enables the worm to fasten the silk where it wills, and which is soluble in warm water. In countries where there are steam-reeling establishments, it is generally more profitable for the small raiser to sell his cocoons, and not go to the trouble and expense of reeling by hand; but, unfortunately, there is no market for choked cocoons in this country, and the raiser will be under the necessity of reeling his own silk if he wishes to make the most of them. It will be desirable, then, in this article, to state the facts and principles which should govern the unwinding and reeling,

for the benefit of those who may wish to use single basins and reels worked by hand. In the great reeling districts of France, everything is brought to such perfection in the *filatures*, or reeling establishments, by the aid of steam, that the hand-reels have there almost gone out of use. But most of the silk is unwound by hand-power in China, and excellent silk may be made by dexterous management with a good hand-reel.

Raw silk is classified into organzine, tram, and floss. Organzine is considerably twisted and is the choicest. Tram is made from inferior cocoons and is but slightly twisted. Floss is made of the loose silk, carded and spun like cotton or wool. The thread of silk as it unwinds from the cocoon is valueless for manufacturing purposes, several of them combined going to make the staple of commerce. The persons employed in unwinding silk are mostly women, one standing or sitting before each basin, of which she has entire charge. The basin is made of copper, and, in the large establishments, the water in each basin is heated by steam, at the control of the operator. The cocoons are plunged into the water, when it is near the boiling point, and moved about so that the gum which fastens the threads becomes uniformly and thoroughly softened. They are then beaten with a small birchen broom, having the tips split, so that the loose threads readily fasten to them. After beating a short time, the operator gets all the cocoons fastened, and, taking the bundle of threads, shakes the cocoons till each hangs but by a single one. She now takes up five or more threads (*brins*), according to the quality of the silk wanted, unites them, and introduces the combined staple or strand (*fil*) into a little glass eye on one side of the basin. She then forms a second similar strand and introduces it into a second eye on the other side. The strands are then brought together, twisted several times, separated above the twist, and introduced into two other glass eyes or ringlets through which they are led, one to each end of the reel or *tambour*, which is kept revolving in a steady, rapid manner, and to which is also given a certain back-and-forth side motion. The great object in reeling is to get the threads uniform, rounded, well joined, properly freed from moisture, and so crossed on the reel that they will not stick or glaze, as it is termed.

These objects are attained by the twisting and the to-and-fro lateral movement of the reel, as also by properly regulating the distance between reel and basin. The uniformity of the thread depends on the skill of the operator, who must supply a new thread as soon as one begins to give out. This is called nourishing the silk, and is done by dexterously casting, with the thumb, the new thread upon the combined strand, to which it immediately adheres. In this she must use much judgment, for the silk of a cocoon gradually gets lighter and finer as it approaches the end, and the uniformity of strand does not entirely depend on the uniformity in number of the individual threads forming it. Whenever the silk rises in locks the temperature of the water is known to be too hot, and when it unwinds with difficulty the temperature is, on the contrary, too low. The operator is supplied with a skimmer with which to remove all chrysalides and refuse silk; also, with a basin of cold water in which to cool her fingers, which are being constantly dipped in the hot basin. This constitutes the whole operation of unwinding, but before the skeins, as they come from the reel, are ready for the manufacturer they must undergo still further manipulation. The staple is first passed through a cleanser, consisting of a clasp lined with cloth, which catches any loose silk or other matter that may be adhering to it. It is then further cleansed and purged by being passed through four similar cleansers (*purgeurs*), then twisted about 500 times to the yard, then doubled and again twisted about 400 times to the yard. It is finally run on to reels about 1½ feet in diameter, and taken off and twisted in a peculiar knot or hank. Through all these operations the oscillating to-and-fro lateral motion is kept up, so as to produce the diagonal crossing of the strands, and it will be readily understood that each staple is, in the end, composed of ten or more of the simple threads first spun by the worm. The loose or flock silk, together with all which, from one cause or another, cannot be reeled, is soaked in water for three days, boiled for one-half hour in clear lye, washed in rain-water, and when dry, carded, and spun it makes an inferior floss silk.

**Food Plants of the Silk Worm.**—The traditional food plant of the silk-worm is the Mulberry (botanical genus *Morus*). There are two species of Mulberry indigenous to the United States, namely, the Red Mulberry (*Morus rubra*) and the Small-leaved Mulberry (*Morus parvifolia*), neither of which is suitable silk-worm food. I have tried in vain to rear the worms upon *rubra*, but they either refuse its leaves entirely or dwindle and soon die upon it. The imported species which are most used are the white (*M. alba*), the *Mul icaulis*, and the black (*M. nigra*). This last is inferior to the other two as silk-worm food. The mulberry grows readily, being easily propagated by cuttings or layers or from the seed. The white

mulberry, in particular, grows well from cuttings, and this is perhaps the readiest and most economical method of planting to secure a stock. The cuttings should be started in rows, three or four inches apart, in ground prepared by deep plowing and harrowing. They should be about six inches long, and should be cut just before an eye in every case. They should be almost entirely buried. The quickest way to get a supply of leaves is to grow dwarfs.

Set out the young trees from the nursery in rows ten to fifteen feet apart, and six to eight feet between the rows, and form the crown of the tree by cutting down to a foot or so from the ground. The height of the tree and its form are easily regulated by pruning, and upon this process depends not only the vigorous growth of the tree, but also the ease with which the leaves may be gathered when desired. The pruning may be done in February or March, either every year or every other year. All dead twigs and dried bark should be removed and the limbs kept as smooth as possible, as this greatly facilitates picking. The best time for planting is in the fall, from frost until December, and in the spring, from March until May. For growing standard high trees, a practical raiser gives the following directions: The cutting should remain two years in the nursery without pruning. The third year it is cut down close to the ground and transplanted. The finest shoot is then allowed to grow, and in good land it will reach a height of eight or ten feet in one season. The fourth year it is cut back to six feet or thereabouts. Then, the three or four terminal buds only being allowed to grow, all others are removed as often as they appear by passing the hand along the stem. The *Moretti*, a variety of the White Mulberry, is profitably grown in the form of a hedge, and the large size of its leaves makes it a very desirable variety.

**Osage Orange.**—The cultivation of the Osage Orange (*Maclura aurantiaca*) is so well understood in this country that there is no need of giving detailed instructions on the subject. Very generally used as a hedge plant in those sections of the country which are particularly adapted to silk-culture, its leaves may at once be obtained without any special investment of capital. Those who use this plant as silk-worm food must, however, bear in mind that the shoots from a hedgerow become very vigorous and succulent by the time the worms are in the last age. These more milky and succulent terminal leaves should be thrown aside and not used, as they are apt to induce flaccidity and disease. In avoiding these more tender leaves, and using only the older and firmer ones, especially when the worms are large, consists the whole secret of the successful rearing of silk-worms on this plant; and if care be had in this respect there will be no appreciable difference in the silk crop from Osage Orange as compared with that from Mulberry. Should the worms, from whatever cause, hatch before either Mulberry or Osage Orange leaves can be obtained, they may be quite successfully fed, for a few days, upon well-dried lettuce leaves. It will, however, be worse than a waste of time to attempt to feed them entirely on these leaves, or, in fact, on any other plants than the two here recommended.

**Enemies and Diseases of the Silk Worm.**—As regards the enemies of the silk-worm but little need be said. It has been generally supposed that no true parasite will attack it, but in China and Japan great numbers of the worms are killed by a disease known as "uji," which is undoubtedly produced by the larva of some insect parasite. Several diseases of a fungoid or epizootic nature, and several maladies which have not been sufficiently characterized to enable us to determine their nature, are common to this worm. One of these diseases, called *muscardine*, has been more or less destructive in Europe for many years. It is of precisely the same nature as the fungus (*Empusa muscæ*), which so frequently kills the common house-fly, and which sheds a halo of spores, readily seen upon the window-pane, around its victim. A worm, about to die of this disease, becomes languid, and the pulsations of the dorsal vessel or heart become insensible. It suddenly dies, and in a few hours becomes stiff, rigid, and discolored; and finally, in about a day, a white powder or efflorescence manifests itself, and soon entirely covers the body, developing most rapidly in a warm, humid atmosphere. No outward signs indicate the first stage of the disease, and, though it attacks worms of all ages, it is by far the most fatal in the fifth or last age or stage, just before the transformation.

It appears very clear that no remedies are known, but that care in procuring good eggs, care in rearing the worms, good leaves, pure, even-temperatured atmosphere, and cleanliness, are checks to the disease. The drawers and other objects with which the diseased worms may have been in contact should be purified by fumigations of sulphurous acid ($SO_2$), produced by mixing bisulphite of soda with any strong acid, or, better still, by subjecting

them to a carbolic-acid spray from an atomizer. In this way all fungus spores will be destroyed. In fact it will be well to wash off the trays or shelves once in a while with diluted carbolic acid, as a sure preventive. It is the best disinfectant known to science. The cheapest kinds may be used with the same efficacy as the more expensive. Another disease, known as *pébrine*, has proved extremely fatal in Southern Europe, and for twenty years has almost paralyzed silk culture in France. It is a disease which, in its nature and action, except in being hereditary, bears a striking analogy to cholera among men. "The worms affected by *pébrine* grow unequally, become languid, lose appetite, and often manifest discolored spots upon the skin. They die at all ages, but, as in *muscardine*, the mortality is greatest in the last stage. It is hereditary on the mother's side, because the moth may have the germ of the disease and yet oviposit. Indeed, the eggs may be affected and yet look fair and good, the microscopic *psorospermiæ* not being visible, so that the only true test of disease or health is an examination of the parent moth; and by killing off all infected moths the disease can be controlled.

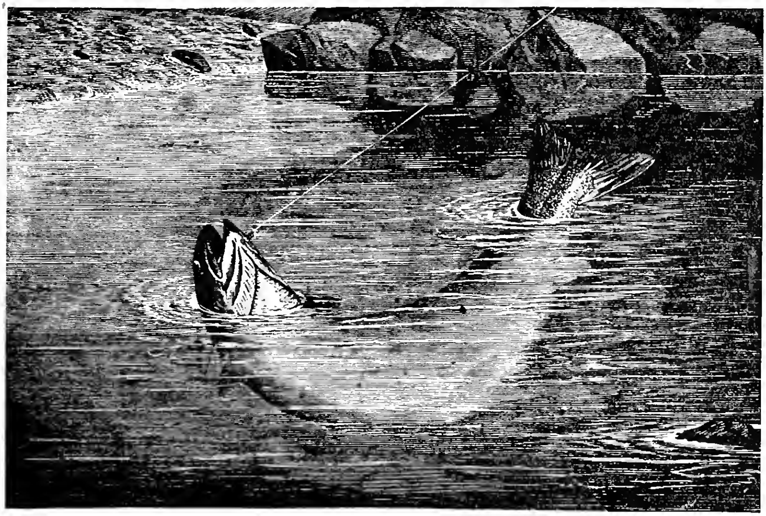
"Both the diseases mentioned are, therefore, in the strict sense of the word, silk-worm plagues; the one of a fungus and the other of an epizoötic nature. Each may become epidemic when the conditions are favorable for the undue multiplication of the minute organisms which produce them, or when the checks to the increase of such organisms are removed by carelessness or ignorance." Cleanliness and purification are absolutely necessary in treating both these diseases, and in *pébrine* care must be taken to see that the eggs are sound by a microscopic examination of the moths. This may be done after the eggs are laid, and if the corpuscles be found in the mother, her eggs should be discarded. Silk-worms are subject to other diseases, but none of them have ever acquired the importance of those described. What is called *gattine* by older authors is but a mild phase of *pébrine*. The worms are apt to be purged by unwholesome leaves; too great heat makes them sickly; or they may become yellow, limp, and die of a malady called *grasserie* or jaundice, which is almost sure to appear in large broods, and which is very common in those reared in this country. When the worms die from being unable to moult they are called *lusettes*, and such cases are most abundant at the fourth moult. All these different ailments, and others not mentioned, have received names, some local, others more general; but none of them warrant further notice here, as they are not likely to become very troublesome if proper attention and care be given to the worms."

**Silk Culture in the United States.**—There is no reason why the successful rearing of silk-worms may not be practiced in any portion of this country that lies south of 40°, the principal objections to be met being the expense of labor, and the want of a ready market for the cocoons. Professor Riley states that there is at present a general and wide-spread interest indicated in this country on the subject of silk culture. He mentions the obstacles to be encountered, and the fact that under a heavy protective tariff our silk manufacturers have rapidly grown in importance and wealth, until during the recent annual report of the Secretary of the Silk Association of America, raw silk to the value of nearly $12.000,000, and waste silk and cocoons to the value of $769,186 were imported at the ports of New York and San Francisco, while our manufactured silk goods reached in value between $35,000,000 and $40.000,000, and says: "The obstacles which I have set forth are none of them permanent or insuperable, while we have some advantages not possessed by other countries. One of infinite importance is the inexhaustible supply of Osage Orange (*Maclura aurantiaca*) which our thousands of miles of hedges furnish; another is the greater average intelligence and ingenuity of our people, who will not be content to tread merely in the ways of the Old World, but will be quick to improve on their methods; still another may be found in the more spacious and commodious character of the farmers' barns and outhouses. Every year's experience with the *Maclura* confirms all that I have said of its value as silk-worm food. Silk which I have had reeled from a race of worms fed on it, now for eleven consecutive years, is of the very best quality, while the tests made at the recent silk fair at Philadelphia showed that in some instances a less weight of cocoons spun by *Maclura*-fed worms was required for a pound of reeled silk than of cocoons from mulberry-fed worms."

Silk culture is admirably adapted to the invalids and children of the family, as well as to all other persons who desire some light and pleasant employment, as for instance those members of the farmer's household who are not otherwise engaged in more remunerative employment.

# FISH CULTURE.

IT is no longer a novel idea that fish may be cultivated in nearly all waters to such an extent that there may be established a permanent and profitable business for furnishing an abundance of food of this kind. It seems to be within the power of man to multiply the inhabitants of the waters almost indefinitely by artificial propagation, he being subject principally to the limitations of the elements of sustenance, viz., a sufficient supply of water, and of food in the water. Statistics show that the salmon fisheries alone of Great Britain now aggregate in value over five million dollars annually, and that in one year the product of the rivers of Scotland, Ireland, and Wales that was furnished the London market was nearly four millions of dollars; also that the river Tay in Scotland yields an annual rental of eighty-five thousand dollars from its salmon fisheries, and that by artificial breeding it was increased to this amount within a few years from the sum of forty thousand dollars. The river Tweed yields its proprietors an annual sum of one hundred thousand dollars. We also



THE LAST STRUGGLE.

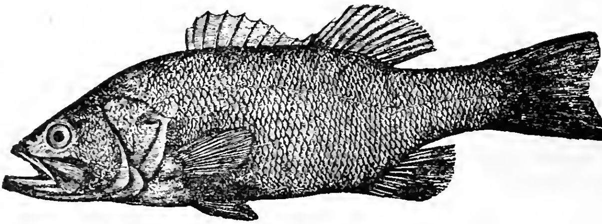
find that the salmon fisheries in the river Moisie, in the province of Quebec, increased in seven years by artificial propagation, from 75,000 to 204,000 pounds. It is but little more than thirty years since the artificial propagation of fish was commenced in Europe, and now it has become an established industry, France, which takes the lead, deriving an annual income of nearly twenty millions of dollars from her fisheries, Russia eighteen millions, Norway seventeen millions, and, as previously stated, Great Britain markets of one kind of fish alone over five millions of dollars. While in this country fish culture has received but comparatively little attention, it having been but a few years since the first efforts in that direction were attempted, great advancement has been made during that time, in developing this art.

Although the artificial propagation of fish might be called a new science among the higher civilized nations of the earth, yet it has been long practiced by some of the heathen nations, especially the Chinese and Japanese, who for thousands of years have sustained, to a large extent, their dense population upon fish, a large proportion of which was artificially propagated. The French have the honor of originating fish culture in the manner at present

practiced among civilized nations, their efforts being attended with such marked results that other European nations were not slow in following their example.

Considerable interest has already been awakened throughout the country in regard to fish culture upon farms, or in private fish ponds. This may be easily done, and with but comparatively slight expense and labor. Almost every farm has some stream or pond that may be utilized for this purpose, or if not, at least land of a low, marshy, swampy nature, that is almost worthless for any agricultural purpose whatever, but which might be transformed into a fish pond. and made more valuable in the production of fish than any equal area of the very best land for any agricultural product. Fish of suitable kinds bring a good price in the market, many—such as the brook trout, salmon trout, etc., frequently commanding exorbitant prices. But when it is not desired to supply the market, simply an abundance of fresh fish for family use, fresh from the water, is of no small import, and is a luxury that few families far from a market ever enjoy, since no food of any kind deteriorates in quality so quickly by keeping as fish. For the following practical directions on the breeding and management of fish we are indebted to Mr. Seth Green, Superintendent of the Fisheries of the State of New York; also noted in this country and in Europe for his valuable experiments and discoveries in the art of fish culture.

**Points in Fish Culture.**—"The following points upon fish culture seem to be established: First—Fish culture, extending to every desirable variety of fish, is entirely practicable. Second—It may, under proper management, be made profitable to the producer; as much so or more than the cultivation of land, or of land animals. and on similar conditions. Third—It may furnish to all classes an abundance of cheap, and the most nutritious and healthful food. Fourth—It is absolutely necessary in order to the preservation of the fish of the country from total destruction. Fifth—Every section of our country, and all its



BLACK BASS.

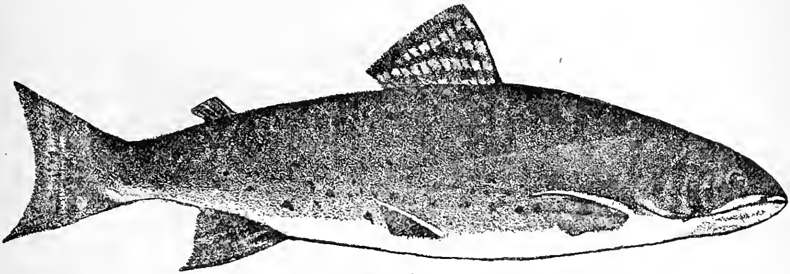
creeks, rivers, lakes, and seacoasts are available for this, care being taken that the right kinds of fish be selected for the water into which they are placed, observing latitude, climate, temperature, and quality of water. Sixth—It may be carried on by stocking waters with young fish brought from hatching establishments, or by obtaining eggs for hatching, and both eggs and young fish may be transported safely to almost any distance. Seventh—The money capital required for these operations is small, skill, care, patience, perseverance, and common sense, the same as in any other business, being the chief requisites. Eighth—Individual enterprise is alone sufficient for success. though State action is desirable; indeed, legislation is essential, if not to foster, at least to protect those engaged in the business of fish culture.

**Varieties of Fish Best Adapted to Fish Culture.**—The fish of North America are the finest in the world for food and sport, while some species have peculiar recommendations to the fish culturist. Probably the most valuable variety to be found anywhere is the shad; it is scarcely surpassed for the table, it is among the most prolific, it is the most easily manipulated, its eggs hatch in the shortest time, its fry require no care after birth, and being migratory. it draws its sustenance from the sea while it travels far inland, in its periodic visits to the land. We have abundant varieties for the vast extent of valuable waters in our states, from the sluggish, turbid streams and ponds of the South, to the lively sparkling spring brooks of the North; from the smallest ponds to the immense inland seas of fresh water. For the lakes the Whitefish, Salmon Trout, Herring, Black Bass, and Wall-eyed Pike; for the rivers, the Yellow Perch. Black Bass, Shad. and Salmon; for still and deep streams, the Bullhead or Catfish, the Perch, and many other kinds of coarse fish; for the swift mountain

stream, the Trout, Gold Fish, a good coarse pan fish, can be grown in all our rivers and bays. Beyond doubt, with very little care and expense these fish can be made to abound in our waters. But for some kinds this requires government aid, since individuals owning parts of streams will not hatch out fish there at their own expense for the benefit of all other owners of the stream, and special legislation seems to be required to get fish passes constructed over the numerous dams in our rivers, and to prevent substances destructive to the fish being thrown into our streams, such as saw-dust and the refuse of paper mills, tanneries, and dyeing establishments.

But if with comparatively little care and expense our great rivers can be stocked, in the meanwhile there is room enough for private enterprise. There are few farmers in our country who do not have upon their land a lake, or spring, or clear running stream. If these men knew how easily they could turn this water to profit, not only by raising food for themselves, but a supply for the city and village market, there would soon be very few waters without their finny inhabitants. How much this would add to the wealth of the country any one can see at a glance.

As the shad are probably the best and most valuable fish for the public, so is the trout wherever it belongs or can be acclimatized the most desirable for individual purposes. The shad yields the largest amount of food, while the trout holds the highest price in market, and possesses as a subject of sport a still higher value. Where neither shad nor trout can live some variety of the fresh water bass will answer for private or public waters, and the pike perch (wall-eyed pike) is admirably adapted to larger rivers and lakes. There is hardly any pond, stream, river, or lake, be it large or small, that cannot be utilized, and the land owner that has not the facilities for raising salmon may supply his family with an excellent article of food in the shape of bull-heads or gold fish.



THE ANGLER'S PRIDE.
BROOK TROUT (*Salma fontinalis*).
(Two-thirds full length.)

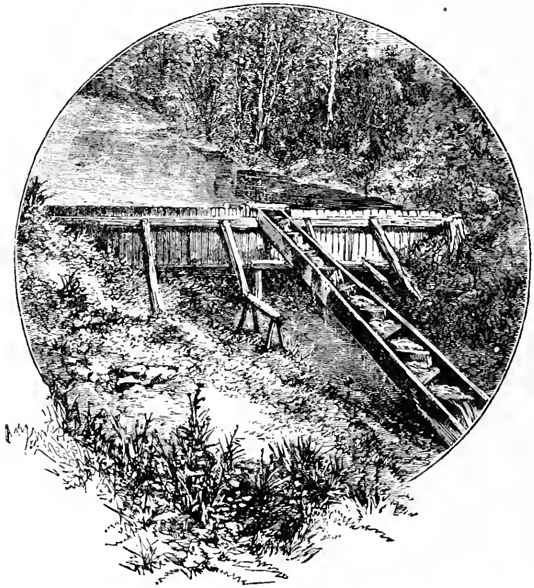
The number and kinds of fish that are treated are increasing daily. The Chinese probably confined their efforts to carp. We began on salmon. Then the effort was extended to trout, then to shad, to salmon trout, to whitefish, to striped bass, to sturgeon, to smelt, to grayling, and indirectly to black bass, strawberry bass, oswego bass, pike perch, yellow perch, catfish, oysters, lobsters, gold fish, and other fresh water fishes, and we may confidently expect in time, to assist nature in multiplying all or nearly all the fishes that live on our coast or in our lakes and rivers. Not a year passes but some new and valuable discovery is made, and the importance and interest of fish culture increases with every development.

There are certain well marked eras in fish culture in which the main discoveries have been made. Most of the appliances adopted abroad have been abandoned with us, and great strides have been made in developing the art. Our first great discovery was what is known as dry impregnation, that is, the use of little or no water in impregnating the eggs with the male fluid. This was kept a secret, however, from the public until it was re-discovered in Russia. Here it was first practiced in 1864, and up to that time twenty-five per cent. of the eggs was the greatest number impregnated; immediately afterwards the proportion rose to seventy-five per cent. and is now ninety-eight. At present "dry impregnation" is universally adopted.

The next great discovery in appliances was the shad hatching box, which has never been superseded for certain classes of fishes and situations, nor has it been improved on since it

was invented. Another seemingly trivial but extremely important discovery was the application of coal tar as a coating to wood work and all articles that come in contact with the eggs, and on which fungus could do harm by growing. The last was the invention of the Holton hatching box for hatching white fish, but which is a valuable convenience in managing the eggs of all the salmon and trout. These discoveries have reduced the labor and expense of fish culture immensely, and have added in an equal degree to efficiency and certainty of success.

**Trout Ponds, Location, etc.**—It is very easy, with good spring water, to raise a *few* trout anywhere in temperate latitudes. But to raise a large number requires care in the selection of a location. Plenty of pure spring water is the first and most essential requisite. The spring, or one of the springs, if there are several, should have a fall of two or three feet, and a fall of five to ten feet of the whole volume of water is decidedly advantageous. If the supply of water is very large, it diminishes the necessity of a fall. The water from a spring remains (near its source) at nearly the same temperature during the whole year, and is the best for trout raising. The water from a brook which does not rise higher than sixty-



POND AND FISH-WAY.

five degrees in summer may be used to supply ponds for adult trout; but spring water is not absolutely necessary for hatching purposes. It is not a good plan to dam up a stream which varies in volume, and so make ponds. There should be enough level land by the side of such a stream to make ponds supplied by the stream; and it is best to have a stream much greater in volume than is necessary for the ponds, so that there will always be a good supply of water, and there will be no trouble with the surplus water after a freshet. A good knowledge of the whole system of Trout Culture is essential in choosing the very best location. It is desirable to have your ponds near your house, or have a man in charge living at the ponds. Of course your trout may never be molested, but "an ounce of prevention is worth a pound of cure."

**Laying Out Ponds.** — A series of ponds, in all of which the same water is used, is generally considered the best plan for several reasons. It economizes the water and space,

and is most convenient for changing the fish from one pond to another. It is not necessary that the ponds should be in a straight line. Where the location demands it, they may be turned so as to lie in a direction nearly or quite parallel with one another. This is easily done by bending the raceways, and lengthening them if necessary, only a curved raceway is sometimes not so convenient as if it were straight. The sides of the ponds may be walled up with stones, laid without mortar, unless the soil is very sandy. Wood may be better for the sides and bottoms, but we are inclined to think is not worth its expense. If the sides of the ponds are laid up with mortar, let it dry thoroughly before letting the water in; then let the water run through it two or three weeks, or long enough to purify the pond before putting any fish in it. It is as well to test it by putting in only a few fish at first; if the pond is not thoroughly purified, the fish in it will turn blind. Ponds should not be built where much surface drainage will run into them; if they are so exposed, the surface water should be carried off by a ditch around them. The second and third ponds should receive an additional supply of water. If the supply of water is small, it is best to have as much fall between the ponds as the nature of the ground will allow This fall aerates the water, and makes it as good as new.

HATCHING HOUSE, NURSERY, AND POND.

**Shape of Ponds.** — Where the supply of water is large, it matters very little about the shape of the ponds. The best shape we believe to be the pear shape, such a shape combining an equable flow of water in all directions, and the greatest amount of surface with the least difference in the temperature of the water. If the nature of the ground demands other shapes, the ponds should be made long, narrow, and deep, rather than broad and shallow. The depth of the first pond should be 2 feet, the second 4 feet, and the third 5 feet. These depths will answer for any size of ponds. It is better for any one wishing to raise a large number of fish, to have several series of ponds, than to attempt raising a larger number by increasing the size of the ponds. Fish do not feed so well in large ponds, are not so easily taken care of, and eat each other more.

**Raceways.** — The second and third ponds should have a long, narrow raceway where the water enters — about thirty or forty feet long, four feet wide, and six inches deep. The sides of the raceway should be made of one and a half inch plank, one foot in width. This will answer for both natural and artificial impregnation. The raceway is required not only for the purpose of spawning, but as a resort for the fish at all seasons of the year. Fish will go into this shallow graveled race, into the quick-running water, to free themselves from the parasites which often trouble them; or they will go there if they are out of health and condition from any cause. This raceway must be filled with coarse gravel, and the bottom of the pond made to slope gently up to the raceway.

The head of the raceway is to be carefully looked after. If a series of ponds are made, then the screens between will keep the fish from running from one to the other; but if single ponds are used, each supplied with separate water from a stream, then much attention must be paid to the screens where the water enters. It would be well if the water was brought into the pond through a long box, as the water will very soon work around or under a short box, and allow the fish to escape. If the water enters with a fall, it may be allowed to pour over upon an apron, constructed of thin slats, one-half or one-quarter of an inch apart, and set edgeways. This will let the water through, and keep the fish from running up. Trout will run up stream very freely, working their way through a small passage, but will not try much to run down stream.

**Wild Raceway.** — If the ponds are connected with a stream in which there are trout, it is desirable if possible to make a raceway below the lowest dam and connect it with the stream, so that wild fish may use it. In this way a great many trout will be taken in a ripe condition that would otherwise spawn in some other part of the stream and be lost. The wild raceway has the advantage not merely of utilizing fish that have not cost any expense to keep, but of adding to the number of spawners for the following year by the addition of those that are thus captured.

**Bottom of Ponds.** — It matters very little of what material the bottom is composed. Anything — mud, clay, or moss is good, except gravel, and this is bad, not from the nature of the substance, but because the fish will spawn on it and the eggs be lost. Sometimes a person will wish to construct a pond in a place where there are springs, or to dam up the water and make a pond in a springy place. Under such circumstances it is a good plan to fill the bottom entirely with gravel, as the fish would spawn there in any case. For such a pond make the borders very shallow, so that the little fish may run up into the shallow water and escape from the large fish; or have the pond so arranged that after the fish have spawned they may be removed. Thus the eggs will hatch out, and the little ones grow without danger. When the next season of spawning comes, the little fish may be removed into another pond, and the old ones let in again to spawn. Such a pond is good for any one wishing his establishment to run itself, as with a little care he can raise many fish in it without much trouble. But the gravel must not be smaller than a hickory nut, and from that to the size of a butternut.

Very often the bottom of a pond is porous and absorbs the water as fast as it runs in, so that there is hardly any running from the proper outlet. If you are short of water and wish to use all you can get for another pond, it is best to cement the bottom. If you have no further use for the water, it makes no difference how it goes off; that is, if there are no holes in the bottom large enough to let the fish escape, and the water keeps up to its proper level. Neither weeds nor mosses of any sort are necessary at the bottom, and if the supply of water is not large they will speedily become a nuisance. The quantity of trout food which they produce is of no account in an artificial pond where large numbers of trout are kept, and they tend to foul the water by hiding dead fish and bits of meat. It is best, if possible, to have ponds so arranged that they can be entirely drained. This is necessary sometimes for cleaning or repairing them, and changing the fish from one pond to another. If the slope of the ground is sufficient to permit of such an arrangement, it will often save much labor in pumping or bailing. The drain pipe may be of pump logs, tile, or pipe of any kind, and should be fixed in the lowest part of the bottom, or as near it as the level of the ground will allow. Still better would be a regular flume reaching from the bottom of the pond to the top. A bulkhead may be put in to raise the water as high as may be required, and a wire screen the whole size of the flume set a short distance in front of the bulkhead. This large screen has

an additional advantage, as the larger the screen the less liable it is to clog up with leaves and moss, and the greater will be the volume of water passing through it.

**Screens.** — Screens may be made of common wire painted with tar — as will be described hereafter — of copper wire, or of galvanized iron wire. The last is the best, as it will last longest in proportion to its cost. The screens for keeping the small fry should be of fourteen threads to the inch, and for one-year-old fish five or six threads to the inch. Incline the screens at an angle of forty-five degrees, the top being farthest down stream. By inclining the screens in this manner, a greater surface is exposed to the water than if they were placed perpendicularly. The sockets should be so made that the screens will fit tightly, and yet be easily taken out to clean.

A very good screen for two or three-year-olds can be made from strips of lath planed and nailed to a strong frame, with quarter-inch openings between them. Or, what is better, the slats should be at least four inches wide, so that if a leaf strikes against them it will catch without obstructing the flow of water and lie flat against a single slat, or if it reaches over the edge it will be carried through by the current striking upon one end. It cannot lap around the slat as it would if it were smaller. As for the width of the slats from one another, the point to be guarded against is the fish running their heads through far enough to strike their eyes, which will produce blindness. The distance they are to be apart will depend, consequently, mainly on the size of the heads of the fish, and as fish grow at different rates of speed it will not do to go merely by their age, but for fair-sized fish an opening of about five-eighths of an inch will answer. This refers to the upper screen; the lower screen, that at the foot of the pond, may be larger, as the fish are more cautious about descending where they cannot see their way, just as a man will climb a hill in the dark at his best speed, but will go down very cautiously.

**Water Supply.** — It is immaterial what kind of water is used, whether hard or soft. Neither will so-called "mineral water" hurt the trout, unless the water is very strongly impregnated. Trout have been known to live and thrive in a stream one-sixth of whose volume was supplied by a strong sulphur spring. The essentials are that the stream shall be reasonably pure, the volume of water nearly uniform, or so arranged that the supply taken from it is uniform, and the temperature between 36° and 65°.

One peculiar fact has been noticed in reference to the eggs, which is important to those persons who collect eggs to impregnate and sell. The shells of those taken from trout living in limestone waters are found to be thicker and harder than those obtained from soft waters. This may come from the lime in the water, and is an advantage in rendering the eggs more easy to transport with safety than where the shells are very delicate.

The supply of water necessary for a given number of trout is yet unsettled. For a series of ponds turning out one thousand large fish yearly, the water supply should fill a four-inch pipe. This question will be treated more at length hereafter; but it is always safe to have as much water as possible, for within reasonable limits one can hardly have too much — that is to say, if the dams and sluices are solid, and the screens do not clog. It must not be forgotten that abundance of pure water is as essential to fish, as abundance of pure air to man.

In saying that ponds must not have a gravelly bottom, we do not mean there should be no gravel. The trout must have access either to the raceway or some other spot of gravel to rub off parasites. This they cannot do if the bottom is wholly of mud, and they are excluded from the raceway.

**The Hatching House.**—If only a few eggs are to be hatched (say eight or ten thousand) no hatching house is necessary. The troughs may be placed in the open air, in any convenient place, and covered with a wire screen to keep out rats, mice, and ducks. A light board cover must then be laid over them to shed the rain and snow and keep the eggs from exposure to the sunlight. A hatching house is much more comfortable to work in. A stove may be put in it and a fire started occasionally for warming one's fingers, but it is not needed for hatching purposes, as spring water in these latitudes is warm enough. The house may be constructed of rough boards, or as expensively as you choose, but care should be taken to have a water-tight roof, as drops of water leaking through and falling into the troughs will kill the eggs underneath. Its size must be regulated by the number and extent of the troughs.

The windows in a hatching house should be few in number and provided with curtains or shutters, as the sun shining upon the spawn will kill it. Not that a few minutes exposure to the rays of the sun will hurt the eggs, but a few hours exposure certainly will. Perhaps it

would be as well to have the windows, if possible, made on the north side of the hatching house, into which the sun will not shine in the winter season. Keep the hatching house clean. In fact cleanliness is one of the cardinal virtues to the trout raiser. He should have a clean house, should work with clean hands, and have all his pans, spoons, and utensils of every sort free from grease and dirt.

**Troughs.**—These should be made of seasoned timber one and a half inches thick. They should be six inches deep and about fifteen inches wide, inside measurement. It would be better, perhaps, if the troughs were eight or nine inches deep, because then the water could be raised higher over the young trout after they are hatched out. The difficulty in making them so deep is that when the sides of the trough are made so wide they are apt to warp or stretch apart at the top, and must be stayed in some way ; for instance, by strips nailed across. But the cleaner the trough is of all strips, elbows, or grooves the better. The troughs are divided into squares or nests by cross strips set on the bottom at intervals of eighteen inches. The reason for this division into nests and for these cross strips will be seen further on. These strips may be made of half-inch stuff and cut two inches in width. There is no necessity for nailing them to the bottom ; fit them in accurately and set them edgeways at intervals of eighteen inches. As they do not need to be removed often, it is better to make them fit tightly. Other strips of the same stuff must be provided to fit upon these. and made wide enough to raise the water within an inch of the top of the trough; as these need to be often moved they must be made loose enough to take out, and yet fit accurately enough to raise the water over them when they are put in. A groove is sometimes made in which to run the strips, or shoulders nailed to the sides against which to set them, but it interferes with the equable flow of the water. New wood under the action of water develops a slimy sap, therefore it is necessary to paint the troughs with hot coal tar mixed with enough turpentine to thin it to about the consistency of paint. Glass has been used to cover them, and the wood has been charred to prevent the growth of fungus. but nothing answers so well as gas tar, which should be used to cover every thing in the troughs or ponds, and where fungus can do harm. The troughs should have an inclination of about one inch in eight feet—just enough to let the water ripple gently over the cross strips. They should not be longer than twenty feet, or the air in the water will be exhausted before the water reaches the end of the trough. There is more danger of this after the eggs are hatched out and the troughs are full of young fish. If possible the hatching house should be so far below the level of the spring from which its supply of water is derived, as to allow the troughs to be raised two or three feet from the floor. Where a large number of eggs are to be hatched, the inconvenience of stooping to care for them is very great.

**Water Supply.**—From the filter, the water runs into the distributing trough or pipe, which runs along the head of all the hatching troughs. The water may be let into the hatching troughs by faucets, or through holes cut into the trough. These holes should be covered with netting, or the young fish will run up out of the troughs into the filter, or coarse gravel may be heaped up at the head of the trough through which the water will run, but through which the young fish cannot work their way. The supply of water for one trough should be equal to that coming through a three-fourth-inch hole with three inches head; just enough to make a gentle ripple over the cross-pieces. Be careful to get the troughs level crossways, and the strips true, so that when the water is running, it will form an equal current over every part of each strip along the whole length of the trough. If the water runs unevenly, the eggs will be washed into a heap if they are being hatched on gravel, and many of them spoiled for lack of proper circulation of water around them. This supply of water will be sufficient until the eggs are hatched out, when a somewhat larger supply can be allowed. The water should be brought directly from the spring in a pipe of some kind, in order to preserve the proper temperature and keep the water as free from sediment as possible; and for the same reason the spring should be walled up to its smallest possible dimensions. If any surface water naturally runs into the spring, a ditch should be dug around the spring to lead it off. If the muddy surface water is suffered to run into the spring which supplies the troughs, the screen will very soon be choked up, and the sediment will find its way into the troughs in spite of all precautions, and destroy the eggs.

**Filter.**—The filter is a box six feet long by one and a half feet wide, and one and one-half feet deep, in which four or five flannel screens can be placed through which to filter the water before it passes into the troughs. The coarsest and cheapest red flannel is the best. It will rot and must be renewed once or twice in a season. Red flannel will last twice as long as

any other. The flannel should be tacked on frames running in grooves set at an angle of forty-five degrees, (the top down stream,) so as to expose as much surface as possible to the water. If the hatching house is small, the filter may be placed outside, but is better under cover. If the spring is well protected the screens will not need cleaning very frequently They should be cleaned as soon as they look dirty, however often that may be, and can be cleaned best by being taken out and washed with a soft brush.

A filter can be made with sponges placed in a box with the water introduced at the top and brought out at the bottom, provided there is fall enough. The box should be about thirty inches long and twelve wide, and a board perforated with holes should be placed below the sponges, and leaving a space between them and the outlet pipe. This will answer on a moderate scale where only a small amount of water is used, and only a few hundred thousand fish hatched, and the sponges will remain clean for months. There should be an overflow pipe from the top to make sure that there is a sufficient supply of water and to carry off the surplus.

Sediment falling on the egg keeps the water off and destroys its life as effectually as being buried in the ground would destroy a man's life. If sediment falls upon the eggs it may be removed by gently agitating the eggs with a feather, or better still, by creating a current in the water with a feather, which current the eggs will follow, and as they roll over, the sediment will drop off. But the trout breeder has no business to be troubled in this way. If his apparatus is rightly constructed, and his filter properly attended to, there will not be sediment enough in the troughs to hurt the eggs, from the time they are put in until the fish are hatched out. The pipe which is let into the spring should have wire netting around it where the water comes in, to keep out impurities. This netting should be spread out so as to give a greater surface than the mouth of the pipe. If the netting covers only the mouth of the pipe, every speck of dirt which lodges on the netting diminishes by so much the supply of water; but if the surface of the netting is increased, much of it may be stopped up without lessening the supply of water. The best way is to make a box, say one foot square for each inch of diameter of the pipe, and run the pipe through a hole in the middle of the board, fitting it well; then fit a screen of netting on the front side in grooves so that it can be taken out and cleaned. This should be looked after occasionally, but if the spring is closely walled up, and the netting placed beneath the surface of the water, it will not probably need cleaning through the season.

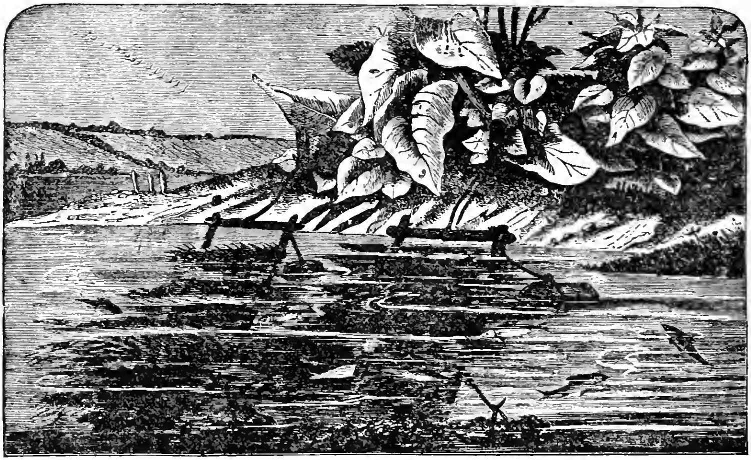
**Gravel for Troughs.**—The gravel for the troughs should be quite fine—about the size of peas. It is better to use wire screens, as will be explained hereafter, but where only a few eggs are to be hatched and it is important to avoid expensive preparations, gravel will answer. It was formerly used altogether, but is now almost wholly discarded. It is better to have it of a uniform size. Any kind of gravel is good which is free from iron rust, as that kills the fish. If the gravel is of some dark tint, the dead eggs, which turn milk white, will show very plainly upon it, and may easily be picked out. The gravel should be well washed before use, and we would even recommend boiling it, to destroy any eggs of insects which may be adhering to it. After the nests are prepared the gravel may be put in, one and one half inches deep, which will bring it within one-half inch of the top of the cross-piece.

**Implements.** The implements of the fish-culturist are few and simple. A few feathers may be kept on hand to use in spreading the eggs when placing them in the troughs, in collecting them for packing, and moving them in the search after dead eggs. Several plans are in use for removing dead eggs from the trough. Some use a siphon to draw them up; others bend wire into the shape of a small spoon, or bend an eye upon the wire just large enough to hold the egg. We recommend the use of nippers. These may be made of wire or some elastic wood like red cedar, bent or cut into the shape of the letter U, elongated to about six inches, and with loops of wire at the ends about the eighth of an inch wide. These will hold the egg without trouble. A small homœopathic phial is used to examine the eggs. The manner of its use is to fill it with water, put in the egg to be examined, cork it, hold it up before the window in a horizontal position, and with your microscope look *up* through the side of the phial. This brings the egg which lies at the bottom of the glass within the focus of the microscope, and the water does not distort its shape. This seems to be a very simple thing, and hardly worth telling, but of the hundreds who have tried to examine eggs in our hatching house, not a half dozen got it right until told how to do it. The microscope need not be very strong; one magnifying eight or ten diameters is amply sufficient. A small net will be of use in removing the young fish and any refuse in the water from the troughs; it should be about six inches in diameter, in the shape of the letter D, with the handle on the middle of the

bend. It is very easily made by bending a wire in the desired shape, and twisting the two ends together for a handle. Thin gauze of some kind, like bobinet, should be spread over the wire so tightly that the middle of the net shall hang only a half inch below the level. An iron spoon, well tinned or silvered, is used to remove the eggs. Some six-quart tin milk-pans will be necessary, for a variety of purposes Eggs may be counted most easily by measuring them. For this purpose take any small glass, such as a very small tumbler, for instance, count out 500 or a 1,000 eggs, and with a file make a mark upon the glass as high as they reach, and the measure is always to your hand.

A watering pot with a fine rose spout is used to wash sediment from the eggs on the seives, and a broom of wings is used to brush the screens of wire

**Improving Streams.**—Where a person has a small stream on his place which is adapted for trout, but is not large enough to accommodate many, or grow them to a good size, it can, at very small expense, be made a considerable source of pleasure and profit All that has to be done is, to dig small ponds or long, narrow holes, say three or four rods long, and five feet deep, and throw some logs or brush in them. If possible, lay the logs crosswise near the bottom, in order to have the water work under them and make a clean "scour."



ARTIFICIAL SPAWNING BEDS.

Then all that has to be done is to place some trout fry in the brook above the ponds. As the fish grow they will settle down into the ponds where they can find shelter and safety, and whence they can be taken with a hook and line whenever they are wanted; the danger of fouling around the brushwood being an additional excitement to the angler. The fish need not be fed, as food sufficient will accumulate upon the logs and brush.

**Spawning Season—Salmon and Trout.**—The salmon family of the Atlantic States, including the eastern salmon, the salmon trout, the brook trout, the whitefish, and the lake herring, spawn in the autumn and fore part of winter. The grayling spawns in March and April, the California salmon in summer, commencing the latter part of August, and the California mountain trout in spring, beginning with the middle of March. Trout commence to spawn about October. The colder the climate is, the sooner they will spawn. In Caledonia Creek the trout lay their first eggs about the 12th of October; the water standing then at about forty-eight degrees. In the preserves, where the temperature at that time is a few degrees higher, they begin to spawn about the 1st of November, and cease about the 1st of March. The length of the spawning season depends upon the equality of the temperature of the water. In streams where the temperature does not vary much, winter or summer, the

length of the season is three or four months, sometimes more, and in cold mountain streams it lasts only two months, closing by the middle of January.

**Signs of Spawning.** — As the season of spawning approaches, the difference of sexes shows more clearly. It is very hard in the summer to tell the difference between a male and female trout. By handling them much and watching them closely the trout breeder comes to know the male and female apart almost instinctively; but he would be puzzled to tell just *how* he knows it. The male is generally sharper jawed than the female at any season of the year, and lines drawn from his shoulders to his tail would be straight without any bulge in the middle, while the female has a rounder jaw, and even in summer is more protuberant in the middle. These are general signs, and by no means universal. It is only in the spawning season that difference of the sexes can be told with any certainty. As this season approaches the distinctions become more marked. The difference in size is one peculiarity, as the eggs grow large and fill the belly of the female. It will not do to mistake food for eggs. A trout recently gorged with food looks just like a female full of eggs; but the food soon disappears, as the trout is an animal of quick digestion, while the swelling caused by the maturing eggs gets larger as the spawning season approaches. The colors of the fish, also, are at that time a guide. The female turns to a dark and sombre hue, while the colors of the males grow very brilliant, a line of brilliant scarlet red often developing itself along his sides on the edge of the belly.

**Natural Spawning.** — As the spawning season approaches, the trout seek places in the creek adapted to the purpose. These places have a pebbly bottom in shallow water close to the spring or head waters of the creek. The trout will work their way up over the shallows of a stream clear to the source; but if there are springs in the bottom, which is the case with almost all creeks, they will invariably spawn there, without going up farther, or if they find a shallow place with gentle current and gravel bottom anywhere in the creek, they will use it. Very few of the eggs laid in such a place will come to maturity unless there happens to be a spring. The males sometimes go up the stream first. At this season the males engage in fierce contests for the possession of the females.

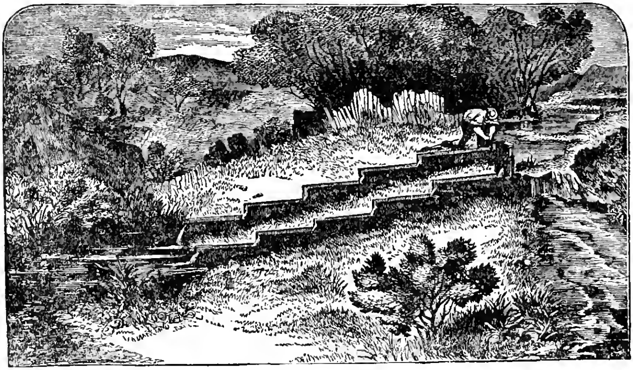
These battles often end in death to one or both of the contestants. That these battles are fierce, the deep wounds left on the dead bodies of the slain will bear witness. They have been known to fight for two days, and then both be killed. However, when they are once mated the battles cease and the pair are hardly ever seriously interfered with. Intruders in any quantity come around, seemingly out of curiosity; but, no matter what their size, they leave as soon as the husband, for the time being, darts at them. These intruders are, perhaps, waiting for a chance to devour some of the stray eggs which the female drops. The male and female being paired, go to the chosen place. They lie side by side together when not disturbed; but the male is occupied most of the time in driving off interlopers. It is very curious to see a little male with a big female in charge. Usually the little trout clears the way for the large one without a show of resistance. In the ponds when the trout are fed, the largest get the meat while the little ones get out of the way, and swim to the further side of the pond, and even if the meat is thrown where they are they will not take it until they have waited to see whether it is not the pleasure of the big fellows to claim it. At the spawning season all this is changed; they will attack a trout three times their size if he comes within less than a respectful distance of the female. Often while the male is driving off one, another on the opposite side will make tender advances; quick as a dart the proper husband returns to chase the gay deceiver. In fact, his time is fully occupied with chasing off intruders. If they are too numerous the female will dart from the nest over which she hovers, to help her chosen mate.

A nest is made in the gravel by the female. It is simply a shallow hole about six or eight inches in diameter, and about two or three inches deep. This is made by diving down at intervals against the gravel, and as she comes up giving it a flirt to one side with her tail—nearly the same motion as may be often observed when trout dart down to the bottom and rub their sides against it to free themselves from parasites. The dipping motion is continued for some days until the nest is large enough to suit her. After lying over this for some time the female is ready to emit a portion of her eggs. The male lies by her side while she does so. However busy he may have been in driving off interlopers, he seems to know by instinct when the female is ready to emit her eggs and is always by her side. At the time she emits her eggs he emits his milt over them. They do this with a curious curl upward, which every trout breeder should see for himself. Very often the male and female lock jaws together and their heads slowly rise, apparently trembling with excitement. They emit eggs and milt until

a nearly vertical position is gained, still lying over the hole, then they fall away from one another, and the male retires to some secluded spot, where he remains five or ten minutes resting. This interval the female employs covering her eggs. She will *flirt* in with her tail all the stones of proper size to be found near her nest, and if there are not enough to cover it to her liking she will go above, and, picking out a particular stone, work it down backward between the two ventral fins. This labor she continues until the eggs are completely covered.

After five or ten minutes the male pays her a visit to see how she is getting along. He looks around a little, eats a few of the eggs if he can find any uncovered, and then retires to his lurking place again, where he remains twenty minutes, with only occasional visits to the female before he recovers from the exhaustion which he has undergone. The female does not seem to rest; she continues covering the eggs and does not then leave the place. The reason for this is that she has not yet emitted all her eggs, for trout occupy some time in their spawning, laying their eggs at intervals, as they become ripe. Observers differ as to the length of time occupied in spawning. The time is not usually more than three days, although sometimes extending to six days, the female covering the eggs as she emits them.

When it is understood that some of the eggs do not sink into the nest, but are carried off by the current, and that only a part of every hatch escape the jaws of their parents, and of the many trout swimming around the spawning place, one may begin to perceive the advantage of artificial methods. To make the danger of loss greater, after the nest is finished, the



HATCHING BOXES.

parents gone, and the eggs nicely hatched, another pair come along intent on similar business. The female sees the place where the first has laid her eggs, and, fancying it a good spot for her own nest, begins to make one there. As soon as the eggs are uncovered, by the preparatory operations, the pair eat up all they can find, and then proceed to lay their own eggs, only perhaps, to be served in the same way by others. When it is considered, also, that all kinds of water-fowl are fond of these eggs and diligently search after them, and that in the spring time the young fry furnish a large proportion of food for the older ones, the wonder seems to be, not that there are so few trout in our streams, but that there are any left. Another cause of the rapid diminution of trout in settled countries, is the tame ducks which are allowed on the stream. They wander at will peacefully up and down the stream, explore every foot of the bottom, turning over the gravel with their long bills, and leaving very few of the eggs to hatch.

**Number of Eggs.**—The number of spawn which a trout will give has been variously estimated. She commences spawning at two years old if well fed and large. It has been asserted that eggs have been taken from a trout one year old, or rather taken in the winter of the same year it was hatched. This may be so, but it is more interesting in a physiological point of view than for any practical purpose, as there are so few that it is not worth while to

take them. A trout two years old will give from two hundred to five hundred eggs, a three-year-old from five hundred to one thousand eggs, a four or five-year-old from one thousand to two thousand eggs. This is only an approximation, as the number of spawn depends upon the weight and health of the fish, and not on its age. In some cases the number of eggs is much greater, but four thousand is the most we have ever seen taken from one trout. In estimating the number of spawn from a given number of fish in a pond, it must be remembered that some are barren, and some diseased, and some, perhaps, will not go up into the race. So that the average yield of two or three-year-olds, females only counted, will not be over five hundred, of four or five year-olds, not over one thousand each.

The proportion of males to females in a pond should be about one-half. Not so many are necessary to fecundate the eggs, and it would be an advantage in one way to have fewer, since then there would not be so much fighting in choosing partners, and as all the females do not spawn at once, one male would be enough to serve several females; but, on the other hand, the males seem to run out of milt before the females get through laying their eggs, and towards the close of the season it is often difficult to obtain males with milt enough to fecundate the eggs; so that it seems better to have in the pond an equal number of males and females, thereby giving more chance of saving some of the milt till the last of the season. The males are very amorous, and will pair again and again. It very often happens that some of them die from the exhausting effects of the season. The best way is to have an equal number of males and females, everything considered.

**Taking Spawn by Hand.**—The trout will not spawn in the ponds where the bottom consists of large stones or weeds; but if there is sand or gravel anywhere on the bottom of the ponds they will spawn on it. Therefore be careful to have all the raceway, where the waters enter, covered with gravel. In October this may be washed and cleaned from the weeds which will have grown in it during the year. As soon as the fish are ready to spawn they will ascend from the ponds into the raceway seeking a place to nest. Then they are ready to be taken out and the spawn expressed. At the entrance of the raceway there should be grooves to receive a frame on which is tacked a net of coarse bagging about eight or ten feet long. One corner of this bag should be narrowed, left unsewn, and tied with a string, like the mouth of a meal sack. The race should be covered over in spawning time, as the fish will come under the cover better and are not so likely to be frightened by any one passing. If there are fifteen hundred or two thousand fish in the pond the net may be used every day in the height of the season, and when the fish become scarce, once in two or three days.

Indications of spawning having been observed, the covers are put on the races, and as soon as there are fish in the raceway, the net is gathered up in the one hand and the frame held in the other, in such a position as to be put in the grooves as quickly as possible so as to let none of the fish escape from the race. Go quietly to the spot, and do not walk down the raceway to get to it, but approach from one side and put the net in the groove as quickly as you can. The water running down will swell the net out to its full length. The covers may then be removed, and with a stick you may frighten the fish down from the head of the raceway into the net. As soon as they are all in, the frame may be lifted out of the water, and the fish are then enclosed in the bag. A tub of water should be previously brought near the spot, and the end of the net can be lifted into the tub and untied, when the fish will all fall into the tub without any trouble. Coarse cloth is better for the purpose than netting, as it can be more easily tacked to the frame, does not hurt the fish so much, and lasts longer; besides, the water swells it out and holds it open for the fish to run in better than it would a net, and the fish not seeing you through the cloth as they would through an open mesh, are not scared, and do not try to run back up the race.

It must be remembered in this and all subsequent handling of the fish, that if the outer skin of a trout is broken or abraded by the hand or in contact with any hard substance, it will, in nineteen cases out of twenty, cause the fish to die. A white fungus appears on it first where the skin is broken; the fungus spreads over the fish until it is sometimes half covered with it before it dies. We speak of the covering of trout as "skin," because it feels like it and looks like it, although in reality trout are covered with minute scales. They will get over a deep and clear cut much more quickly than over a bruise where the cuticle or skin only is broken.

The fish being now in the tub, must be taken to the hatching house as quickly as possible. There are probably in the tub some fifteen or twenty fish, and all the operations must be conducted as quickly as possible, so that they will not die in the small quantity of water to

which they are confined. So long as the fish lie quiet in the bottom of the tub there is sufficient air in the water to sustain them, but as soon as they begin to come to the surface and try to leap out, it is a sign that the air is nearly exhausted and the water should be renewed. They will also open their mouths wide, just as a person would when gasping for air. The question has sometimes been asked how long a trout would live out of the water; the answer is, about as long as a man would live under the water. Trout will die in a tub out of which the oxygen has been exhausted by their breathing, more quickly than they would die in a cloudy day if out of the water entirely.

A fire may be made in the hatching-house to warm your fingers, which will probably get cool while engaged in this operation. A six-quart milk pan is to be provided, if you have many fish, and also another tub of water, into which to put the fish after they are deprived of their spawn. Select a fish, and holding it over the milk-pan, which has been dipped in water to wet it, rub it gently with the fore finger and thumb, from the pectoral fins to the vent. A little experience will show how this is to be done. If the fish is ripe, a few drops of pearly colored milt, or orange hued eggs, will be forcibly expressed into the pan. If the milt is not of this color, it shows that the milt is not good, and another male must be taken and treated in a similar manner. The female must be pressed more slowly and oftener than the male. If the eggs are not ripe, by passing the hand lightly over the belly, you will feel them beneath, hard, like shot. In that case put the fish back into the pond, for the eggs to ripen. When the eggs are ripe, the belly will be soft and flabby, and the eggs beneath the skin feel loose and change their position at the touch. So loose are they, that by holding the fish in a horizontal position, and then moving it up and down, the eggs will change, and fall downwards or upwards as if in a bottle. The operation must be continued until the fish are emptied of eggs and milt. The eggs in the pan may, at intervals, be gently stirred by moving the pan; this is to change the position of the eggs, so as to be sure that all come in contact with the milt, and when the operation is completed a half-pint of water is poured on them and the pan set in one of the hatching troughs through which the water is running; this will keep the eggs up to the proper temperature, and prevent a sudden change when they are transferred to the trough. The eggs will now agglutinate or stick to the pan, and to each other, for a little while.

In handling the fish, gentleness is essential. A trout, it is well known, may be tickled under the belly, and rather seems to like it, and will lie quiet in your hand while you are doing it. By putting the hand quietly in the water, moving it cautiously around the fish, and gently lifting him he may be raised high and dry, and will lie quietly without a struggle. There is a way of grasping a trout firmly, but gently, so that he cannot squirm, and yet not hard enough to break the skin.

The fish must be grasped by the head, if you are right-handed, with the right hand, and by the tail, or rather the lower part of the body, with the other hand, and held over the pan with the belly near the bottom of the pan. As soon as the fish is quiet, the right may be gently slipped down from the head, and the fore finger and thumb used to press the belly, the fish still being held by the tail and lower part, in the left hand, and partly supported, perhaps, by the sleeve of the coat, or by the bare arm, and the remaining fingers of the right hand. Every one will have a way in which he can do this best, and will find it out after a few trials. If the fish is large and struggles violently, the usual direction given in the books, is to let an assistant hold the head. We counsel you, if the fish struggles violently, whether it be large or small, to drop it back into the tub, manipulate another, and after a few minutes try it again; it will lie quiet after a while. If you attempt to hold a fish which struggles violently, you will be very apt to kill it. If, in addition to your own two hands, you get the two hands of an assistant on the struggling fish, there is not much chance of saving him alive. A better way is to file the barb off a No. 4 hook; then tie it with three feet of line to a pliant switch three feet long. Hook your fish on this, through the jaw, and holding it in a tub of water, let it struggle until it is exhausted. Then the hook can be slipped out, no injury having been done to the trout, which can be handled without difficulty.

The large trout are harder to handle, struggle more violently, and are more apt to be killed than the smaller ones, and do not average so many eggs, although now and then one will have a very large number. Therefore, we consider that the best fish for breeders, when the operation is conducted by hand, are those weighing from one-quarter of a pound to one pound.

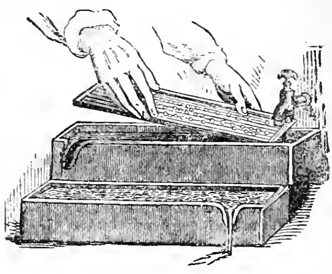
The pan should be elevated at one side, during the operation of taking the spawn, by standing it on a block half an inch thick, and enough water will drip from the fish so that by

tilting and shaking it the milt can be brought in contact with the eggs. Formerly it was the custom to half fill the pan with water, but now the eggs are mixed as dry as they can be, and it is found that a far higher percentage are impregnated. The milt seems to drown in water quickly. Only enough eggs should be taken to cover the bottom of the pan with a single layer. If more eggs are to be had, more pans should be used, and as soon as all the fish have been handled they should be returned to the water

It takes very little milt to impregnate a large number of eggs, but, in practice, we generally take all the milt we can get out of the haul. It is sometimes our custom also to put the male fish, whose milt has been exhausted, into a pond by themselves, to keep them from running up into the race again and troubling the females. This is a very good plan, if you have plenty of ponds and plenty of fish. If you have but a small number of males compared with the number of females, put them back again into the pond, as they will probably have a second and third renewal of milt.

After stripping a female once she should be returned to the tub from which she was taken, and should be stripped again after a short time during which other fish are being handled. This is to get the last egg from her, and if it is not done a few will remain, and she will go on the spawning beds to deposit them, as if she had a full supply. If she is cleaned entirely she will not bother herself or her owner about the matter again that season. The California mountain trout retain their eggs and milt with more determination than our

DISCHARGING OVA.



IN-DOOR HATCHING BOX.

brook trout, and must be humored like a cow that will not give down her milk to any one but the creature for which nature intended it. After the trout are handled they are returned to different tubs according to their sizes, as this is the occasion that we take for sorting them, and then they are returned to their proper ponds.

Twenty to twenty-five minutes having now elapsed since the pan of eggs was set in the trough, gently tip up the pan. If the eggs are loose and roll separately as you move it, they are ready for subsequent operations; if not yet loose, let them remain a while longer.

The semen of the male is full of *spermatazoa* or animalcules. These will live for ten or fifteen minutes in water; dry, they will live six hours. There is a hole for the reception of these sperms in each egg. The egg always sinks into the water with this hole at the top. It receives one of the animalcules only by this opening, which then closes. There seems to be a special arrangement of Providence that the eggs shall agglutinate—stick fast to each other and to everything they touch—so that they shall not float away until they are impregnated and the trout has had time to cover them. In the eggs of other fish, such as bass and perch, the same arrangement is seen; only they stick fast the moment they touch anything, and stay there until hatched out, while the substance that fastens the eggs of the trout dissolves as soon as the mother has had time to protect them.

The eggs will now be loose and lying on the bottom of the pan. Pour off the dirty water until only sufficient is left to cover the eggs. If this is done very gently, the eggs, although very light, will remain at the bottom, as they are somewhat heavier than water; then sink the pan into the water, at the same time tipping it as described in the chapter on "Eggs," and take it half full of water. The influx of water will wash the eggs around somewhat, and dilute the dirty water remaining in the pan. This is to be poured off, as before, and the operation repeated until the water looks perfectly clear. There will be some dirt and droppings of the trout still left, which can be carefully picked out with the nippers. If an egg should happen to be broken while being taken from the trout every vestige of it should be carefully removed, as the slimy, sticky contents will get on the other eggs and kill them. The eggs are now ready to be placed in the trough.

From the above description it will be seen that a few lessons in artificial impregnation from an experienced hand will probably save the beginner much time and money. A written description of the process, however good, can never take the place of verbal instruction; partly because it never conveys exactly the same idea to all, partly because seeing a thing is better than hearing about it, and mostly because a written description is a general one, and hardly ever tells of the minutiæ and variations which constantly occur in practice. As an example of this it has been urged, all through this book, that in moving the eggs the beginner should not touch them with the feather, but should move the water over them, so that the eggs should follow the current thus created; also that he should be very careful, in removing the dead eggs, not to touch the others with the nippers. But we constantly move the *eggs* with the feather, and push to one side the sound eggs with the nippers, in order to get at the dead ones. The reason simply is that long practice has given the *knack* of doing it, without injury to the eggs, that a tyro does not possess.

**General Management of Eggs—Placing in Troughs, etc.**—The eggs of a trout are about one-sixth of an inch in diameter and nearly round. They are generally of a light straw or salmon color. The color varies with the meat of the fish; the redder the meat the more orange-colored are the eggs. They are generally of a light yellow or amber color at first, and grow darker as the eggs grow older. Their specific gravity is a little greater than that of water, so that they will sink in water, but may be easily moved in it. Suppose that the eggs are obtained and you have them in a shallow pan. The water in the troughs should be raised by placing a narrow strip across the trough upon one of the two-inch strips dividing the nests. Then sink the pan gently to the edge in the water of the trough, at the same time tipping the pan, so that the water in the trough and in the pan shall come together with as little current as possible. Then the edge of the pan may be sunk into the water, and by tipping the pan a little more the eggs will flow out without injury. By moving the pan while the eggs are running out, they may be spread uniformly over the bottom. If they fall in a heap, take the bearded end of a feather, and move the water with it in the direction you wish the eggs to go, and they will follow the current thus created. This may be done without touching the eggs with the feather. Distribute the eggs as evenly as possible over the surface of the nest. Where they are placed upon wire sieves, these may be moved and shaken under water so as to distribute the eggs evenly.

The strip which was placed across the trough to raise the water should then be removed. Care must be taken that it be not removed so suddenly as to cause a rush of water, which would carry most of the eggs away with it. Raise the strip a little way from the bottom, so as to let the water run out gradually, and when it is very nearly or altogether at the proper level the strip may be removed entirely. Those who have a nursery attached to the troughs place the earliest eggs in the lower end of the trough, and keep placing them toward the top, so that the fish which are first hatched can run first into the nursery without disturbing the others. We practice placing the eggs in the highest end of the trough first, because the eggs earliest placed hatch out first, and the water should be raised over them, as they require more oxygen than the egg. If these first should be placed at the lower end of the trough, in order to do this the water must be raised over all the eggs; if at the upper end, strips can be placed upon the nests in succession as the eggs hatch out and the water left running upon the unhatched eggs as usual. About ten thousand may be placed in each nest eighteen inches by fifteen inches.

If the eggs have been received from a trout breeder they should be left in the packages in which they have been sent until the troughs are ready for them. Persons will sometimes take the tin boxes containing the eggs out of the sawdust in which they were packed and set them in the water of their troughs, with the idea, perhaps, of getting the eggs in the box to

the same temperature as the water before unpacking them. This will surely kill the eggs in a few hours. Leave them in the original package until a few hours before you are ready to place them in the troughs. Then take out the tins and set them over or near the troughs, which will reduce or raise the temperature enough. Then empty the box into a tin pan full of water taken from the trough, pick out as much moss as you can readily with your fingers or nippers, and wash off the nest in the manner shown in directions for washing eggs hereafter.

If the eggs have had decent treatment on the way, that is, not thrown about roughly or set near a red-hot stove, you should find very few dead eggs in the boxes—not more than ten or twelve in one thousand. Should the eggs be found, on opening the box, to run together in lumps instead of being evenly distributed, and turned to a dead white or milky color, it shows rough usage on the way.

**Temperature of Water and Time of Incubation.**—The length of time required to hatch out the eggs depends upon the temperature of the water. A general rule sufficiently accurate for all practical purposes is this: At fifty degrees trout eggs will hatch out in fifty days, each degree colder takes five days longer, and each degree warmer five days less. The difference, however, increases as the temperature falls and diminishes as it rises. The best temperature for hatching is between thirty-five and forty-five degrees. We are inclined to believe that the fish hatched at a temperature of about forty-five degrees, and taking from seventy to seventy-five days to hatch, are stronger and longer lived than those hatched in fifty days at fifty degrees. It may be well also to note that the eggs earliest taken produce the best fish. The water of a spring can be reduced in temperature in winter by letting it run for a short distance exposed to the open air, or it may be collected in a pond and the supply either drawn from the pond or the stream, whichever is regarded as the most desirable. Another reason for delaying the hatching of trout is to bring them well into spring before they are turned loose, as at that time they can get more abundant food than they could earlier.

**Growth in the Egg.**—A great mistake is often made where eggs are to be distributed in retaining them too long after impregnation. This is sometimes done for convenience in shipping, and sometimes with a view of shortening the operation of hatching in the hands of the person receiving them, but it is all wrong.

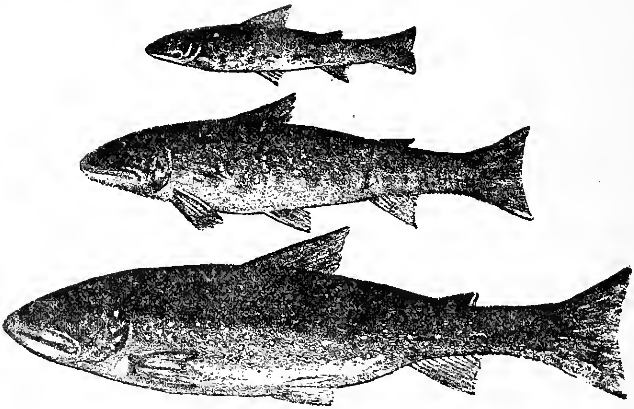
About the twentieth day the young fish can be plainly observed in the egg. Put a few eggs in a small phial, and with a magnifying glass the formation of the fish can be easily seen. Fish farmers should send the eggs away at this time. Some of the eggs are not impregnated, and at this stage of growth may easily be distinguished from the others. The dead eggs will turn to a milk or a pearl white color, and should be removed with the nippers as fast as they are discovered. If left in the trough a fungus growth forms upon them, which extends to the other eggs in the immediate vicinity and kills them. Care should be taken, in using nippers, not to hurt the other eggs, and to do this the bad egg should be feathered entirely separate from the rest; a very slight blow or jam from the nippers will be sufficient to destroy their vitality. Rats and mice in the hatching house often destroy many eggs; they are very fond of them, and, going into the troughs to get them, will destroy with their feet many more than they eat. A wire screen, or boards laid over the troughs, will keep them out; but it is a much cheaper way, and just as effectual, to keep them down by traps or poison. The eggs should be feathered over occasionally, so that their whole surface may be exposed to the action of the water.

**Hatching Trout and Salmon.**—After the eggs have lain in the water from fifty to seventy-five days, according to the temperature, the trout will begin to make their appearance, the egg appears to be endowed with life, and the motions of the trout inside "kicking" against the shell to force their way out can be plainly perceived without the use of a microscope. At length the trout forces his way through, head first or tail first, those that hatch head first always dying, however, and the useless shell floats away down stream. The trout is then about one-half an inch long, and the body proper as thin as a needle; the most prominent features being a pair of eyes, huge in comparison with the rest of the body, and a sac nearly as large as the egg. This sac is attached to the belly of the fish, and contains food, which the fish gradually absorbs. If the fish are hatched in fifty days, the sac lasts about thirty; if in seventy days, about forty-five. At this period of their lives they will work down into the crevices of the gravel and along the sides of the troughs and stay there, nature seeming to give them the instinct at this weak and defenceless period of their lives, when

they are burdened with a load which they can hardly carry, to get out of sight and out of the way of harm as much as possible. At this stage of their growth many curious deformities appear, more interesting perhaps to the physiologist than to the trout culturist. Some of the fry will have two heads, and some will be united after the manner of the Siamese twins. A very common deformity is a crook or bend in the trout, giving it a semi-circular form, so that when it attempts to swim it can only progress in small circles. All the deformed soon die, and may as well be removed from the trough at once. They live as long as the sac supplies them with food; when the sack is exhausted they cannot swim about to get food, and die of starvation.

This instinct of hiding will make the young fry very uneasy if they are placed in a trough without gravel. They will keep continually in motion, or will crowd upon one another in masses, each trying to work his way out of sight under the others. They must now be watched, and carefully moved from time to time if there is danger of their smothering.

**Nursery.** — The most critical period in the life of a trout commences when the umbilical sac is absorbed More, perhaps, die from the time they begin to feed until they are six months old than at any other time. In consequence, many different plans for nurseries have been suggested and used. The fry require a largely increased supply of water, but where only a moderate number is to be raised, in place of erecting other and wider troughs or boxes for nurseries, the better plan is to put only a few eggs, say five hundred, into each square or



SALMON TROUT (ONE-THIRD FULL LENGTH).
(One, two, and three years old).

nest of the hatching trough. The square is then large enough with the water raised to keep the trout well for a month or two after they commence feeding, when they may be transferred into the first or upper pond. This plan economizes space, saves one removal, and the fish do better after a month or two in the ponds than they would in troughs or rearing boxes. It is better to remove the gravel from the troughs as soon as the fish commence feeding, because then the troughs can be kept clean more easily, else particles of food will lodge in the gravel, whence they cannot be removed. The water must be raised by the cross strip before mentioned as soon as the eggs hatch out. It would be well to fix a small screen in each alternate cross strip, which can be done by cutting out a space of eight inches by two, and nailing a fine screen over the opening. This will prevent the trout from running up and down in the troughs, and inconveniently crowding together.

The fry are removed from the troughs into the pond by the use of a small net, such as described among the implements of the fish raiser. Take them upon this, a few at a time, and put them in a pan of water; they will swim off the net, and you may draw it from under them. In the pan they may be carried, a thousand at a time, to the pond in which you wish

to place them. Put them into still water; they will settle down on the bottom, and remain there for some hours; then they will begin to explore their new quarters, and in a few days will become thoroughly habituated to the place.

Boards are sometimes placed over the outer edges of the preserves to give the fish a hiding place and shelter from the sun when they wish it, and, more important than all, to act as a trap for minks in case there is danger of these destructive creatures getting into the ponds; as the boards project nine or ten inches from the sides, if a mink gets in he cannot make his way out.

Where a large number of fry are hatched they have to be left in the troughs until they can be distributed, which is done as soon after the absorption of the sac as possible. In this case the troughs must have all the gravel removed, and must be kept scrupulously clean. A very little decayed meat will render the water offensive, and produce disease. This offensiveness does not show itself in the least in the appearance of the water, which to the eye may be as bright, clean, and sparkling as ever. It can, however, be often detected by the smell. When gravel has been for some time in the tanks or troughs where fish are fed, even with the utmost care, if a handful is taken up it will be found to be very offensive to the olfactories. As well might we expect the human race to be healthy in foul atmosphere as fish to be healthy in foul water. In the ponds it will sometimes answer to cover up or deodorize the feculent matter by throwing earth mixed with a little salt into the water and allowing it to settle; this not only covers the decaying substances, but disinfects them in a measure, on the principle that dry earth is used in the earth closet. The water is to be made quite thick and muddy with the earth, and the operation is to be renewed every few days, as often as necessary. The roiliness of the water does not seem to injure the fish. This, however, at best is but a makeshift, and the true plan, especially with young fry, is to keep the troughs clean.

Cleaning the troughs must be performed daily, in the morning and evening. A thin board, nearly as wide as the trough and shaped like a hand shovel, is made with a short stick for a handle nailed across it. When this is held in the water across the trough, it creates a strong current under it. It is held in the left hand, while in the right hand is a small brush broom, such as is used in cleaning sinks, and with which the sides and bottom of the trough are well scrubbed. All the dirt is sucked under the board, and carried along to the lower end of the trough. The fish are also crowded together ahead of the cleaning operation and out of the way of the broom. When the lower part is reached, the fry are driven above, and the operation completed by netting out the larger pieces of meat or dirt, and by rubbing the finer particles through the screen at the lower end of the trough; or a high cross bar may be put in, the screen raised for a moment, and the waste plug opened.

When there is not accommodation in the troughs for all the fry, and they cannot be distributed, a temporary place of retention may be made by using the shad boxes, which are described under the chapter on shad hatching. They need not generally be set at an angle to the current, as the mere ordinary disturbance of the water near the outlet of the ponds will give them motion enough to change the water. These will answer only temporarily, and must be cleaned as carefully as the troughs. They are to be scrubbed all over the inside and on the bottom. To do this without injuring the fish, the box is tipped up so as to bring one part after the other out of the water, where it can be brushed, while the fry are safely swimming at the other end.

If the fry must be kept in confinement, absolute cleanliness is a necessary prerequisite to their health; but we cannot too strongly impress upon our readers the desirability of turning them into the small rivulets connected with the waters where they are to live, as soon as possible after the sac is absorbed. Although they encounter some perils to which they are not exposed if kept in preserves, they escape still more dangers and acquire the habit of taking care of themselves, which is necessary when they come finally to be thrown upon their own resources.

**Food of Fry.**—The best food for trout fry is raw liver, chopped as fine as possible, and then rubbed through a screen or sieve with a flat stick. It must be reduced to the consistency of pulp, and contain no strings or gristle. A chopping machine is made for chopping hash and sausage, and either that, or a couple of sharp knives are used to chop the liver. What is used is mixed with water so as to reduce it to about the thickness of cream. A teacup full of this mixture will feed a hundred thousand fish when they first begin to feed. The best way to feed them is to take a case-knife, dip it into the food and *slirt* off what adheres into the troughs; a very simple way, but one answering all practical purposes. Care should

be taken not to feed too much, else the surplus food will remain on the bottom, and decaying there, foul the trough. The reason of the difficulty in raising young fish, appears to be that they are literally starved to death. The food which we can give them is not natural to them. it is often given in such coarse pieces that they cannot take it, and sometimes, through the carelessness of a hired hand, they are neglected two or three days at a time.

It is impossible to get natural food for the fry, in fact no one knows what it is, further than that it must be microscopic insects of some sort, as the adult trout are never known to feed on anything but animal food. It is found in the spring runs, even actually in them, as they apparently issue bare of life from the bosom of the earth. Liver is but a poor and unnatural substitute for this food, with fish so delicate as the trout, and if they once get the habit of feeding naturally on what the water offers, they will not take the artificial food afterward. Fish, of any age, learn to eat that food which is most abundant around them. Anglers know this by experience, and use the flies which they see on the stream on which they are fishing. It is supposed that a trout is very fond of grasshoppers, but the trout in one of our ponds which we have fed for a long time with beef lights, will not look at grasshoppers, and will turn up their noses at the fattest and juiciest worms, while the trout fresh caught out of the stream, which we have put in a pond by themselves to educate, will for weeks refuse the daintiest bits of lights and liver. Hunger will after a time drive them to change their food; but with the young ones we cannot wait for this, as they will die off before they learn. As the fish grow older and stronger, more food must be given to them; when six months old, a bowl full of liver will answer for a thousand. When the fish are young, feed often; six or eight times a day for the first two or three months; three times a day will do after three months, until they are a year old.

Young salmon, young salmon trout, California mountain trout, and above all, young California salmon are larger, have stronger appetite, and will accept coarser food. For them, although at first the liver should be made as fine as for trout when they are a few weeks old, it will be hardly necessary to dilute it at all, and in the course of a few months, they will not only take the larger pieces, often tearing them apart, but will scorn the finer portion. At one time, sour milk was almost exclusively used for feeding young fish, but it has been given up. Other foods have been tried, but with no better success. The fish will not thrive on any of them as well as they do on liver, and do not thrive on that as well as if it were a natural food.

As they grow older, other things may be substituted, or may be added to it for a change. They are fond of the roe of other fish, of the spawn of the horse-foot or king-crab; of fish itself, and when they are large enough to eat minnows, no better food can be given them. Liver is too expensive when it has to be used alone for grown fish, and beef lights are usually added to it or used in place of it in a measure. It is miserable food, however, much of it passing through the stomachs of the trout and salmon wholly undigested and collecting in the bottom of the ponds. It injures the digestive organs and must be deleterious to the health of the fish. Its only recommendation is that it is cheap. Maggots are bred on spoilt meat, hung over the ponds, and as they fall off and drop into the water, are readily devoured, and make excellent food. Or a piece of spoilt meat may be placed in a deep bottle like a preserving bottle, and the flies that will collect in immense numbers during summer, may be caught and emptied into the water. This trap will take many times its bulk of flies by being kept set all the time, and emptied when any one is passing it. Flies are probably the best food that can be given to trout.

**Food of Adult Trout.**—In keeping large numbers of fish either for breeding or for sale, the first thing to be determined is, what is the best food which can be obtained cheapest and in the greatest quantities. This question is important because the profit depends upon it. All other circumstances being equal, he who can obtain the cheapest food will make fish raising pay the best. In France and Germany, dead animals are gathered from the farms around the fish establishments and made into *pates*, or pies, which are fed to the fish as wanted. However good this may be for the fish, it is somewhat repugnant to the taste of the fish eater. In this country we pursue a cleaner method. The pluck of animals killed (that is the lights, liver, and heart) is obtained from the butchers. This food can be obtained fresh at least once or twice a week in most localities, and kept fresh by means of an ice house. In fact trout will not eat decayed or spoiled meat unless they are very hungry. They are very dainty in their tastes, and will often go hungry rather than take anything which they do not fancy. We feed meat to them raw.

The lights should be given to the larger fish, as it can not be chopped as fine as the liver,

and is more apt to hang in strips or strings. The liver, which can easily be cut into small pieces, may be fed to the smaller fish. Trout will sometimes choke to death; they are so greedy that they attempt to swallow a very large piece of food, and it sticks in their throats and kills them. Often it is caught in their teeth and thus prevented from going down the throat, or it gets into their gills and stops their breathing. They will, when choking, come to the top of the water, and may sometimes be saved by taking the piece out of their throats, or pushing it down But the best remedy is to chop the meat fine, say one-half or one-quarter inch squares for two and three years old.

No machine which we have ever tried would do the work of chopping to our satisfaction. A sausage machine runs the food together and mashes it, and the meat cutters, which do the best, require cleaning and sharpening so often, that they are only a nuisance. The best thing we have ever found is a butcher's block, or log of wood two and a half feet high on which to cut, and a very heavy knife or light butcher's cleaver. These instruments are very simple, not liable to get out of order, and do the work required of them in the best manner, and with no more labor than a machine would require. Sometimes two or three knives are fastened together to make the work go more expeditiously; but one is best, or at most one in each hand.

Fish fed on liver or lights are not as good eating as wild fish; this is especially so of trout, which should never be sent to market or the table directly from the stew pond. But they soon recover their flavor when they are turned loose, and made to seek their natural food in a natural way.

Any kind of meat is good for food. Trout are carnivorous and will not eat vegetables of any kind that we have ever tried. We feed them lights and liver because it is the least expensive food we can find in large quantities, and answers a very good purpose. In their natural state, trout feed upon insects of all descriptions which abound in or near the water; worms of all sorts, from the angle worm to the caterpillar, which the wind shakes from the trees bordering the stream into the water, are eagerly taken. Flies of every kind which either drop down upon the surface of the water to lay their eggs, or may happen to fall into it, are quickly devoured. Young fish which may be in the stream serve for food; so do grasshoppers and beetles which fall into the water, and even the crawfish is not spared. If any one will examine the bottom of a good trout stream carefully, he will find every stick, stone, and bunch of moss in it covered and filled with insects of various kinds. If you look at the bottom of the creek, also, when it is free from moss and sticks, you will see that in the summer time it presents a curious mottled appearance, as if it were having an eruption of some kind; these protuberances are caused by the larvæ of water flies, which, after a time, rise to the surface, and then breaking their shell or case, for the first time, spread their wings and fly away. On these, before they have assumed the fly-state, the trout feed; and the eggs of water flies, together with minute insects and worms, are the special food of the very young trout.

Fish of any kind are a very good food for trout. If they are small they may be put into the water whole, the trout will take them all the better if they are alive. Any coarse fish which can be obtained cheaply and in sufficient quantities, may be chopped up fine and used as food. As we said before, they will not eat carrion, unless pressed by hunger. They will eat a live trout, but we have never known an instance of their eating, or even touching a dead one. If any way could be devised of raising flies, or shrimp, or various kinds of insects (their natural food), in sufficient quantities and at little expense, this would be the best of all. A change of food would also do them good, but we find that they will not readily change their food.

As to the quantity of food necessary for a given number of trout. This is difficult to give exactly, as it will vary with the size of the fish and the season of the year, more being required in moderate weather than when it is very hot or very cold. For one thousand three-year-olds, about five pounds of lights or liver per day; for two-year-olds, three pounds; but a very little trial will show just how much to feed them. Feeding once each day will keep the trout, over one year old, in good condition. Feed slowly, and as soon as they begin to refuse the food, stop feeding them, then you have the measure, and feed a little less than this quantity every day. We say a little less because we have known cases in which owners of ponds being over anxious to fatten their trout, have killed them by over-feeding. Still this does not often happen, especially if they are fed regularly. A trout after long abstinence will gorge himself to repletion; but will not kill himself to-day if he is reasonably sure of to-morrow's dinner. All animals appear to be wiser than men in this matter, and it is very seldom that they will eat enough to do them injury, no matter how much may be given them.

Salmon and salmon trout, as we have heretofore remarked, will, when they are young, accept food that is rather less finely prepared Their food is of the same general kind, but as they are larger fish they need more of it. Salmon trout can be kept in confinement until they weigh ten or more pounds, whereas, the largest tame trout we have had did not exceed four; but few reached three, it being doubtful whether fish ever attain as full development in the domesticated as in the wild state. As salmon trout will grow to weigh a hundred pounds in Lake Superior, it is probable they may reach twenty in suitable preserves, although the largest we have is not over nine, but he is healthy and is still growing. Salmon trout have been taught to eat trout that died of a natural death; although they at first utterly refused such food, they came in the end to accept it willingly. Trout seven inches long have been disposed of in that way.

Trout and salmon, the latter especially, will get so tame after a time, that they will take the food out of your fingers, in fact they will take the fingers too. Their teeth are sharp, and make scratches like needles. They may be taught to jump for their food by holding it a short distance above the water, or may be made to come up and take it out of the pan you are holding. Feed in the middle of the day when the sun is well up, any time from ten to three is good. Make it a general rule to feed slowly, and give them as much as they will eat without wasting.

Although trout and salmon become so tame that they may be made pets, some hybrids in the State hatching works are so shy that they keep as much as possible out of sight, and can hardly be fed These were a cross of the milt of the salmon, with the brook trout eggs, and perhaps knew that they were monstrosities. There is a board covering to the edges of the preserve in which they are kept, and they hide under it and run hither and thither in fright and confusion if any one attempts to get a close view of them

Salted food has been tried for the feeding of trout, but not with satisfactory results. They do not seem to like it, although it is possible they might be accustomed to it if any important advantage was connected with its use. It, however, ordinarily costs as much or more than the fresh meats, and cannot be superior to them. There is much of the offal of large cities which may yet be utilized as fish food. Where it is allowed to go to waste and run into the rivers adjacent to markets, it invariably attracts wild fish to such places, and if it is satisfactory food for them, it would be equally agreeable to their tame and less particular brethren. The fish breeder must not rely upon getting his food of any kind for nothing, as although most country butchers throw away their beef lights, they will put a price on them the moment they find they are in demand. Three cents a pound is the price usually asked for such food.

The size to which a trout may grow is not very well settled, so many "fish stories" have been told that discredit is thrown even upon well authenticated assertions. Trout may in exceptional cases and in large waters, attain the weight of eight or ten pounds, but a four pound trout is generally considered to be of pretty good size. This question of size is interesting rather to the sportsman than to the trout farmer. It is considered that small trout are the best to eat, those from one-quarter to one-half a pound. A better market may always be found for fish of this size than for any other.

**Precaution Against Escape.**—There will always be a difficulty in so arranging ponds, screens, outlets, and inlets as to keep the young fry in their proper pond. The water is very apt to work holes around the screens or rather around the boxes containing the screens. The young fry will make their way through a wonderfully small hole, no matter how long the distance may be. They will also get through between the screen and the socket, unless these are very well fitted together, and wherever there is a crack into which they can get their large heads, they will put them in so tightly that they cannot extricate themselves, but will die. In short, wherever you can run the blade of a jack-knife, there the young trout will go. In making a pond for them, it is best to beat the edges with a spade until they are perfectly smooth, or, better yet, to put a board around the edges to the depth of a foot.

**Cleaning Screens.**—If the screens are not kept well cleaned, two consequences follow. First the water runs over the top of the screens instead of through them, and the young trout escape; and second, when the screens are taken out to be cleaned a rush of water follows their removal, carrying away with it numbers of trout into the next pond. Whenever you are going to clean the screens drive all the trout from their vicinity, then take the screens out and wash them with a stiff brush. They may be first raked off with a rake if they are made of slats, and then taken out and cleaned. They require attention always once and sometimes twice a day.

**Stocking Ponds.**—The question is often asked by beginners, with what shall I commence fish-farming? Shall I buy the eggs and try to raise them, and wait three years for full-grown fish, or shall I buy adult fish, and from them take fish? The answer to this question depends upon two circumstances. First, how much money you have; and second, how long you wish to wait. It is much cheaper to buy the eggs than the adult fish; but then you will have to wait two or three years before you have any breeders. The wisest and safest plan would be to try a few thousand eggs, and also a few hundred two-year-old fish. Ten thousand eggs would cost thirty dollars, and two hundred two-year-olds would cost about forty dollars. Two hundred two-year-olds would probably give about twenty thousand eggs. If you take this advice, you will have eggs to experiment with the first year. With care, you will hatch out more or less, but in any case your experience will be invaluable to you for the next year, and you will have a stock of breeders, to furnish eggs, as you want them.

**Diseases of Fry.**—This part of fish-raising is least understood as yet. After the egg sac is absorbed and the fry begin to swim about, a sick one is very easily distinguished. The healthy trout swim in the current with their heads up stream, darting about here and there after minute particles of food. The diseased ones wander about listlessly, swimming round and round continually. They may also be known by the size of their heads, which appear much larger than their bodies. The head of a young trout is the largest portion of the fish, even when well, but when sick the fish appears to be all head.

Before the food sac is gone the trout is often afflicted with a swelling over the sac; a membrane forms there, swells out large and is filled with a watery substance. We call the disease "dropsy," or "blue swelling." Sometimes the trout may be saved by making an incision in the swelling and letting out the water, but as with care only a few of them are affected in this way, it is better for the fish culturist to hatch more eggs than he expects to raise than to bother with a surgery he does not understand. In other words, hatch more than you want, and keep the strongest and best.

There is a small worm which is one of the greatest enemies that the young fry have. It spins a web in the water to catch the young fish, just as a spider does on land to catch flies. The web is as perfect as that of the spider and as much mechanical ingenuity is displayed in its construction. It is made as quickly and in the same way as the spider's, by fastening the thread at different points and going back and forth until the web is finished. The threads are not strong enough to hold the young trout after the umbilical sac is absorbed, but the web will stick to the fins and get wound around the head and gills and soon kill the fish. It is even more destructive to white fish, which are much smaller than trout when first hatched. The threads spun by the worm seem to be much finer than the common spider's web, and they are not visible in the water until the sediment collects upon them. They can then be seen very plainly. The webs can not be spun where there is much current and can be easily seen in still water by a close observer. But after all the principal causes of the death of trout are, first and foremost, starvation; nine-tenths of all the young that die are literally starved. Secondly, rough handling; the least twisting or wringing of a fish with the hands will kill it. Thirdly, lack of sufficient water, and fourthly, the temperature of the water. These four difficulties, all of which are preventable, will account for the death of most of the fish that die.

**Diseases and Enemies of Adult Trout.**—The diseases to which adult trout are subject are numerous and often fatal. Sometimes a trout will be observed to have a white fungus growing upon it in spots. This will spread over the fish until it dies. Sometimes fish will turn to a black color. This always seems to be an indication of blindness, as we have never observed this peculiar color unless the fish was partially or totally blind. The fungus which grows upon the fish is probably not a disease, but is caused by, or is the indication of a disease. Nothing is known about remedies. If only a few trout are affected, take them out, as they will be sure to die. If the trout begin to die in numbers, change them to another pond, if possible, or give them more water. This is all we can do for them. The dead trout should be taken out of the pond as fast as they are discovered. They will rise to the surface only in very rare cases, but generally sink to the bottom, and if there is much moss in the pond they are lost to sight, and decaying on the bottom will foul the pond. If there is much sickness among the trout, we generally consider it a sign of insufficient water.

There are but few enemies of the trout in artificial ponds. If the ponds are near the house, and people constantly about them, there will be no trouble with the birds which usually prey upon fish—such as the kingfisher, fish-hawk, and crane. Even if the ponds are some distance from the house, the water will probably be too deep for the fish-hawk and kingfisher to do much mischief, as it is only in shallow water that they can be certain of their prey.

Cranes will wade into the water and take all that comes within reach of their long bills—whether frogs, snakes, or fish. But they are very few in number, and the trout are wary. If any of these birds appear, shoot them. Muskrats sometimes get into the ponds. They can not often catch the trout, but will destroy the young and the spawn if they can get at the troughs, and they eat many of the insects on which the trout feed, besides they make holes in the banks of the ponds and let the water off. A few traps will soon dispose of them. They will make a little bare path, or run on the edge of the bank, by always going in and out at the same place. Then set a trap (a common game trap, such as is sold in all country stores) in the water, so that the plate of the trap will come in the middle of the run and about half an inch under water, taking care to place the jaws of the trap in such a direction that when shut they will be in a line with the run. Then stake the chain in deep water. No bait is necessary.

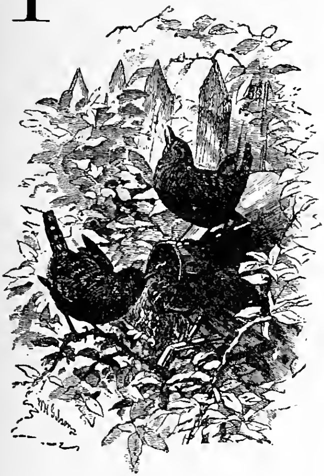
Water snakes can not do any damage to the large trout, but will certainly eat all the little fish they can get hold of. Even if they do no injury, they are not of any advantage, and may as well be disposed of. Cray-fish very seldom eat the young fish. They will lie on the bottom, hidden in the mud, with the joint of the claw wide open and ready; then if any unfortunate troutling passes within reach, his doom is sealed. Cray-fish do much more mischief by their burrowing propensities. They will make holes out of the pond, or from one pond to another, through which the water escapes, and very often the young fish also. The cray-fish is the scavenger of the water, and it may be a question whether a few of them will not do as much good, by disposing of decaying animal matter, as they do harm by destroying a few fish; but they will eat spawn and the fry still encumbered with the sac. The greatest fear of all fish-raisers is that their fish will be stolen at night. A few old logs, stones, and branches of trees strewn on the bottom of the pond, will make it impossible to drag the pond with a seine. Catching them by hook and line is the only means; and if the fish are well fed daily, it will take more time to catch a mess than thieves can usually spare.

Trout also find enemies in their own kind. The only way to stop them from feeding on each other is to give them plenty of other food. It may be as well, perhaps, not to feed them on small fish, unless these are chopped up fine, for the reason that trout soon accustom themselves to certain kinds of food, and will refuse anything strange. If they get into the habit of feeding on small fish, they will not be likely to make a distinction between trout and any other fish. Certain old trout also become destructive to their brethren. Like the "rogue-elephants," and the "man-eaters," among lions and tigers, they become morose and sullen, live apart from the rest, and make war upon everything around. When you find one of this kind, spear him at once, as there is no cure, and he will invariably destroy more than he is worth. It may be worth while to mention here how one trout eats another. An old trout will catch a smaller one, in some cases one-half of its own size, by the middle, and with its strong jaws hold it fast and swim around with it, while the prisoner worries and struggles to get free. This performance lasts until the victim gets loose or is exhausted, being continued sometimes for a half a day. If the little fellow gets free, it is usually to die only a lingering death; for the breaking of the skin is fatal. When it is exhausted, the old rogue, dropping his victim, which until this time he has held by the middle, seizes it again by the head, and slowly swallows it whole; the operation sometimes taking several hours, and while in progress making the fish look as if it had no head, but only a tail at each end.

In some localities minks are very destructive. These animals are particularly to be dreaded because they do not only kill what fish they want to eat, but will take out fifty or one hundred before they stop, and having found a well stocked pond, they will resort to it again and again. The best way to trap them is as follows: "Make a box eighteen inches long by six inches broad and deep, leaving one end open, set a common game trap (such as used for catching muskrats) in the open end of the box in such a position that when the jaws are closed they will be in a line with the length of the trap. If it is set cross-ways it will be apt to throw the mink out instead of catching it. Put the bait in the further end of the box —a piece of meat or a dead fish will answer for bait—set the trap, and cover it over with a large leaf. Now, there is only one way for the mink to get at the bait, which is by working over the trap. Some trout-breeders also try to raise minks for profit, as their skins are valuable; but their habits of eating fish, and their custom of getting out of almost any box or yard in which they are confined do not make them agreeable neighbors for the trout. The fish farmer can always tell by looking at his trout in the morning whether they have been disturbed during the night. If they have been molested, whether by birds, minks, or men, they will appear excited and frightened. The water will be discolored by the mud which they stir up as they dart back and forth near the bottom, and the trout will be nearly all hidden under stones or in the moss."

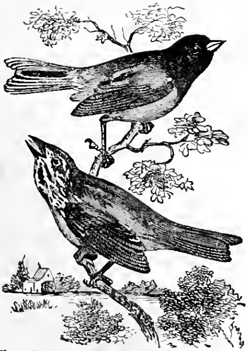
# AGRICULTURAL USES OF BIRDS.

THE practical utility of birds in agriculture as agents for the destruction of various insects, is a subject but little understood or appreciated by farmers generally, yet it is one that can scarcely be overestimated. It is only within a few years, comparatively, that the value of our native birds in the economy of nature has been ascertained by leading ornithologists, and when the knowledge becomes more widely disseminated, and thoroughly understood by the masses, insect-eating birds will receive that protection from the law that their importance demands, and we shall no more see such wholesale and wanton destruction of these innocent servants of man, by the shotgun of the ignorant and thoughtless sportsman, and less destruction of the valuable products of the soil for lack of their efficient aid in keeping the various tribes of noxious insects in check.

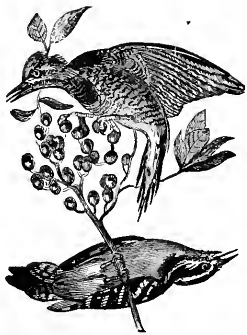


**Classification of Birds.** — The classification of birds most familar to the majority of persons who have given any attention to the subject, is probably that of Illigers and Vigors, as modified from and added to that of Linnæus, the author of this classification, and consists of seven orders, as follows: Raptores, or Birds of Prey; Insessores, or Perching Birds, Scansores, or Climbers; Rasores, or Scratchers; Cursores, or Runners; Grallatores, or Waders, and the Natatores, or Swimmers.

Professor W. A. Stearns, of Amherst College, Massachusetts, says of these orders: "These



Upper Fig.—SNOW-BIRD (*Junco hyemalis*). Lower Fig.—SONG-SPARROW (*Melospiza melodia*).



WOODPECKERS.

seven orders have been in general acceptation for the last fifty years, and it is only until recently that the great advance made in ornithology has reduced the whole sub-kingdom of birds to an almost complete definition. As formerly the Raptores or Birds of Prey

were placed first, so now perfectness of structure and superiority of intelligence have caused the Carrion Crow and Robber Eagle to "step down and out," so to speak, while the well-known Robin, the head of the Thrush family, assumes the head of the tribe, and is soon followed by the more intelligent of the Insessores. As the group now stands we have the following three classes, and eleven orders:

CLASS 1ST. (*Aves Aerea*). — Birds spending most of their time above the earth, among the branches of the trees — in the air, so to speak, comprising:

ORDER 1. Passeres, or Perchers. Order 2. Picariæ, or Woodpecker-like Birds. Order 3. Psittaci, or Parrots. Order 4. Raptores, or Birds of Prey. Order 5. Columbæ, or Pigeon-like Birds.

CLASS 2D. (*Aves Terrestres*). — Birds spending most of their time on the earth, seldom lighting or remaining on trees:

ORDER 6. Gallinæ, or Runners, Scratchers, and the like. Order 7. Grallatores, or Waders.

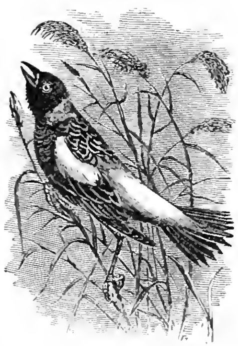
CLASS 3D. (*Aves Aquatica*). — Birds that swim in the water:

ORDER 8. Lamellirostres, Ducks, etc. Order 9. Steganopodes, Pelicans, etc. Order 10. Longipennes, Gulls, etc. Order 11. Pygopodes, Diving Birds.

The system of which these eleven orders form the basis, especially of North American Birds, — though there are very few changes to be made to have the system answer for birds everywhere throughout the world, — proves one of the most simple and most expressive of the real position held by this family in nature of any yet devised. It is only those extreme ornithologists, who strive to render difficult that which they should render easy, whose innovations we have to dread."

SPARROW-HAWK. *Tinnunculus Sparverius* (Raptores).

**Relative Fertility of Birds and Insects.** — In the treatment of this subject and those connected with it in relation to insect-eating birds, we are largely indebted to Mr. F. H. Palmer, of Massachusetts, from whose excellent discussion of this topic we make the following extract: "By studying the habits of birds and insects, we may easily discover the important part which each plays in the economy of nature; and history itself proves that any interference with their relations to each other is sure to be followed by disastrous results. Hence, the subject becomes of deepest importance, not alone to the agriculturist, but to every one who has a business or patriotic interest in our country. Nature, if left to herself, establishes a wholesome balance amongst her creatures; that is, she produces no more of one species than shall be kept in check by another. If there is an insect which feeds upon a certain plant, there is also a bird which destroys the insect, and an animal which devours the bird; and so on up the scale, each curbing the undue increase of the next inferior creature. It is when man interferes with the working of this law that results are sure to follow disastrous alike to his own food, health, and happiness, and that of the creatures around him. It is because he has destroyed their natural enemies that

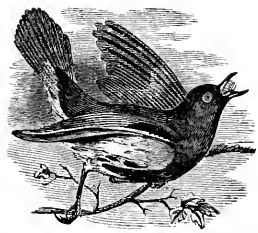


BOBOLINK. (*Dolichronyx oryzivorus*).

insects become a pest; and they will cease to trouble him only in proportion as he shall restore the balance of which Nature shows the necessity. It is not that insects are to be destroyed or condemned as a class. Nothing is created except for the fulfillment of some good end; and the value of insects is not inferior to that of any other class of animal life; none are without their legitimate uses; and it is only when they are stimulated to excessive increase that they become troublesome. Before passing judgment upon them, we must remember that insects are, in a great many ways, very useful and valuable to man. They prepare for us the material for silk, which, in its manufacture, furnishes profitable employment to multitudes of men, women, and children, and brings in large revenues to the country. Insects we must thank for honey, — the sweetest of sweets. The air we breathe and the water we drink are kept pure and wholesome by the agency of myriads of little creatures which draw sustenance from the impurities of the elements. It is not, then, that insects are to be exterminated, even if it were possible, but only kept in check.

Upper fig., Wood Peewee (*Contopus virens*); lower, King Bird (*T. carolinensis*). Insessores.

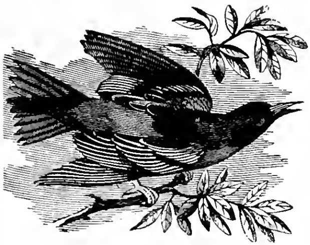
The majority of our native birds have but one brood of young in the course of the year; a few have two or three. In the case of the smaller insect-eating birds, the number of eggs to a brood is, on an average, not more than five. Some of the larger birds, as the various Gallinæ, lay from five or six to twenty eggs to a brood. On the other hand, the reproductive energy of insects is truly marvelous. It is said that a single pair of grain weevils have produced six thousand young between April and August. The common varieties of aphides or plant lice, which are found on almost all kinds of plants, are produced in spring from eggs laid the season before; and through the summer only females are developed. At the last of the season, males and females both appear; and eggs are laid for the brood which hatches early in the spring. Reaumer says that one individual in one season may become the progenitor of 6,000,000,000. The silk-worm moth produces about 500 eggs, the great goat-moth about 1,000, the tiger-moth 1,600, the female wasp at least 30,000. There is a species of white ants, one of which deposits not less than sixty eggs a minute, giving 3,600 in an hour. How, then, shall this enormous mass of insects be kept in check? What shall prevent them from overrunning the country, destroying crops, and devastating the land?



Redstart (*Setophaga ruticilla*).

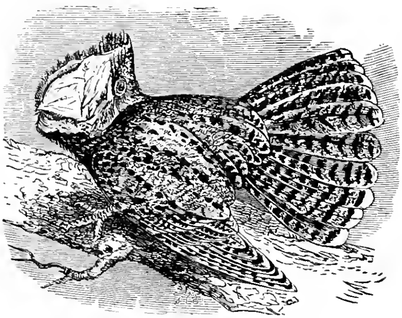
**Food of Birds.** — Various causes operate to check the undue increase of insects, and the chief of these is the appetite and instinct which a wise Providence has given to birds. If the number of eggs produced by insects is wonderful, the number destroyed by a single bird is no less so. Audubon says a woodcock will eat its own weight of insects in a single night. Dr. Bradley says

that a pair of sparrows will destroy 3,360 caterpillars in a week. We saw the parent bird visit a young purple martin on a church spire opposite our windows five times in as many minutes, and each time with an insect. A brood of partridges will nearly exterminate the denizens of an ant-hill in a couple of days. Woodpeckers are constantly employed in ridding the orchards of insects and their eggs, which they skillfully discover under the pieces of dead bark. Robbins, through the spring and summer, are continually hunting for worms and grubs, which they find concealed under the surface of the ground. We recently noticed a common chipping sparrow capture a moth, and, upon depriving her of it, we found it to be that of a common apple-tree caterpillar (*Clisiocampa Americana*), so destructive to the orchards of New England. To check the excessive increase of insects is evidently the great task which birds are intended to perform. Did they have no other office save to cheer and encourage humanity with their beautiful plumage and song, and to typify a purer and more etherial existence to us creatures who 'grovel here below,' even then they would deserve the favor of every Christian and every poet; but when the useful is combined with the beautiful, and a practical value is added to an elevating symbol, they command the interest of every one, and their protection becomes a matter of consequence to all."



BALTIMORE ORIOLE (*Icterus Baltimore*).

Mr. C. G. Maynard, of Ipswich, Mass., who in his investigations has opened the stomachs of more than three thousand birds in order to ascertain the nature of their food, mentions the following number of birds which devour the canker-worm and the larvæ of other injurious insects: Red-eyed vireo, song sparrow, chickadee, scarlet tanager, robin, black-billed cuckoo, wood peewee, least peewee, Wilson's thrush, black and white creeper, blue yellow-backed warbler, Maryland yellow-throat, Nashville warbler, golden-crowned thrush, chestnut-sided warbler, yellow warbler, black and yellow warbler, prairie warbler, black-polled warbler, Canada warbler, redstart, cedar bird, cat bird, purple finch, white-winged cross-bill, chipping sparrow, indigo bird, red-winged blackbird, cow blackbird, bobolink, Baltimore oriole.. The same authority says: "Probably this list may be increased. Besides these birds, those species which occur in orchards during autumn and winter, such as the ruby-crowned wren, brown



CHUCK-WILLS WIDOW.

Upper fig., YELLOW WARBLER; lower fig., BLACK AND YELLOW WARBLER.

creeper, nuthatches, and titmice, doubtless eat largely of the eggs of canker-worms and other insects which destroy or injure the trees. Winter birds of the above species which I have shot at this time have their stomachs crammed with insects of some kind. The Baltimore oriole will eat largely of the tent caterpillar, and is the only bird which will do this. All the thrushes will eat wire worms. The swallows destroy multitudes of dipterous insects (gnats, etc). In fact, to sum the matter up, there is scarcely a bird which will not eat largely of insects at certain seasons, when these pests are most abundant. It is a noticeable fact that many species inhabiting woods and meadows leave their usual haunts and visit the fruit trees which are covered with canker-worms, and largely devour them.

In reference to the currant saw-fly worm (*Nematus ventricosus*), I am not certain that I have seen any birds eat them, yet I think the truly insectivorous species will do this. That the Baltimore oriole sometimes eats large quantities of the American tent caterpillars (*Clisiocampa Americana*), since they have been found in the stomach of this bird, is an interesting fact, for birds as a rule do not relish hairy caterpillars, and the American tent caterpillar is covered with long hairs, though they are not so dense as in some other larvæ."

BLACK-BILLED CUCKOO (*C. erythrophthalmus*). (Scansores.)

Dr. T. M. Brewer gives the following statement: "The most noticeable of all the destroyers of the canker-worm is the common cedar bird, which devours them to an extent perfectly enormous. Next is the purple grakle, which also feeds on them as long as they last. The house pigeon, if in any numbers, is an invaluable bird. Among the other birds, all excellent so far as they go, are the chipping sparrow, the song sparrow, the purple finch, all the vireos—white-eyed. red-eyed, yellow-throated, solitary, and warbling — the king bird, the cat bird, the downy woodpecker, the summer yellow bird, Maryland yellow-throat, the blue bird. The blue-jay eats their eggs in the winter; so does the chickadee. The latter eats their grubs also, and the worm too. The common gray creeper, which is with us only in the winter, eats the eggs.

"Last summer I had a nest of golden-winged woodpeckers breeding on my place. Some of them dug into my barn and passed the winter. Only a part of my trees were protected by a belt of printers' ink, and some of them were partially eaten, but this winter very few grubs have as yet shown themselves, and I give my friend *Colaptes auratus* the credit of all this. I know this, I gave the young ones a lot of worms myself, and they ate them as if they were used to them. The old birds were too shy to permit me to see their good deeds.

"I think the golden robin feeds its young with them as long as they last, but I am not sure that they eat the tent caterpillar. I nearly forgot the two cuckoos, yellow-bill and black-bill. They eat every form of caterpillar, canker worms included. I do not think the robin feeds any to its young, because it would never do; they are too small, and its brood want a big lot. I have known the robin to feed its young for entire days, as fast as they could bring them, with the moth of the cut worm. That is about as much as we could expect any bird to do at one time. At the rate they went they must have caught and given their young ones about five hundred of these moths in a day. Before that I had supposed that the robin did me more harm than good, but I had to give in. My indebtedness to that pair was worth all the cherries I could raise in many years. So the robin and I are fast friends."

**Tabular View of Food for Birds.**—We must conclude, then, after careful examination of the habits of birds and insects, that birds are of the greatest service to man; and that they should be protected and encouraged in every possible way. Nevertheless, it is unde-

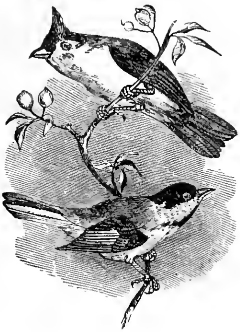
HOUSE-WREN (*T. adon*).

YELLOW-RUMPED WARBLER (*Dendroica coronata*).

niable that this rule has some exceptions; that there are some birds which are far from beneficial, being, on the contrary, very injurious, not only to the interest of man, but also to the well-disposed members of their own race. In short, there are robbers and cut-throats among birds as well as amongst men; and it is just as sensible to pronounce the human race good for nothing because of the depravity of a portion of its members as to say that birds

are useless because a few species are inclined to wrong-doing. The following table will give an idea of the food of some of the more common birds, and will serve as a ready means of distinguishing the injurious from the beneficial species:

ORDER—*Raptores* (Robbers). *Falconidæ*, Hawks, subsist on small birds and animals, and poultry; *Strigidæ*, Owls, mice, reptiles, insects, and a few small birds.



TITMICE.

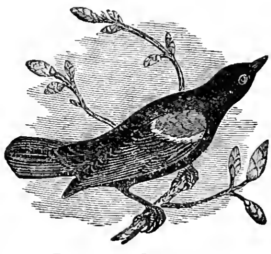
ORDER—*Scansores* (Climbers). *Cuculidæ*, Cuckoos, caterpillars and other tree-insects, and a few eggs of other birds; *Picidæ*, Woodpeckers, insects (a very beneficial family).

ORDER—*Insessores* (Perchers.) *Trocilidæ*, Humming-birds, insects; *Cypselidæ*, Swifts, all kinds of winged insects; *Caprimulgidæ*, Whippoorwills and Night-hawks, night-flying Lepidoptera (very beneficial); *Alcedinidæ*, Kingfishers, fish; *Colopteridæ*, Flycatchers, flies and other winged insects; *Turdidæ*, Thrushes, insects and a few small fruits and berries; *Saxicolidæ*, Bluebirds, insects; *Sylviidæ*, Wood-inhabiters, insects; *Paridæ*, Titmice and Nuthatches, insects and their eggs; *Certhiadæ*, Creepers, insects; *Troglodytidæ*, Wrens, insects; *Sylvicolidæ*, Warblers, insects and the seeds of weeds and grasses; *Hirundinidæ*, Swallows, all kinds of winged insects; *Bombycillidæ*, Chatterers, various insects and cherries; *Laniidæ*, Vireos and Butcher-birds, insects and small birds respectively; *Fringillidæ*, Seed-eaters, various seeds, fruits, and some insects; *Icteridæ*, Starlings, Orioles, and Blackbirds, grains and other seeds, various tree insects; *Corvidæ*, Crows and Jays, eggs and young of small birds, a few insects, corn, and other grain.

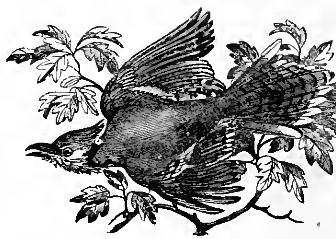
ORDER—*Rasores* (Scratchers). *Columbidæ*, Doves, berries, nuts, and seeds; *Tetraonidæ*, Grouse, various seeds, insects, and berries; *Perdicidæ*, Partridges, seeds, berries, and a few insects.

ORDER—*Grallatores* (Waders). *Ardeidæ*, Herons, fish, frogs, mice, and insects; *Charadridæ*, Plovers, Aquatic insects; *Scolopacidæ*, Snipes, worms, larvæ of insects, and grasshoppers; *Paludicolæ*, Rails, various insects and waterworms.

**Decrease in Number of Birds.**—"It is a mournful fact of history that during the past few years there has been a steady decrease in the number of our native birds in all parts of the country where man has formed his settlements. To account for this fact is easy. Man enters the forests which for hundreds of years have been the undisturbed nursery of birds. He cuts down the trees in which for centuries they have reared their young. He brings with him his gun; and, as long as there are any grouse or other game-birds in the neighborhood, the sharp report and murderous fire are his daily greeting to the wild creatures of the wood. He dams the streams, and turns them aside, and uses their power to destroy the forests on their banks. His snares are set in the valleys, and his traps on the hilltop. His children search the wood for birds' eggs and bring them home to be admired a moment as playthings, without a thought of the happy homes they have destroyed for



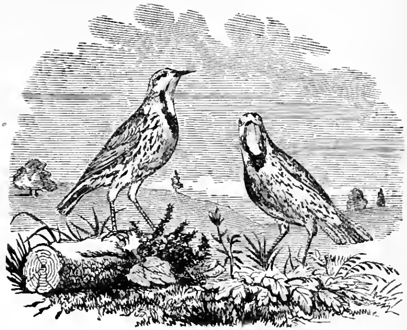
RED-WINGED BLACKBIRD (*Agelaius phœniceus*).



BLUE-JAY (*C. cristata*).

the sake of a moment's pleasure. In short, man has soon taught the creatures, who scarcely feared him at first, that he is a monster to be dreaded, who will give them no rest nor peace. Thus it happens that, as the centuries roll on, one species after another grows more and more scarce, or becomes altogether extinct; and in their loss the world loses more than at the death of the last representative of a long line of imperial princes.

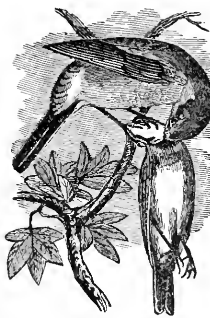
Let us notice from history a few instances of the gradual decrease of some of our birds, that any who are doubting may be convinced. Hear what Audubon says: 'When I first removed to Kentucky, the pinnated grouse were so plenty that they were held in no higher estimation as food than the most common flesh; and no hunter of Kentucky deigned to shoot them. In those days, during the winter, the grouse would enter the farm-yard, and feed with the poultry, alight on the houses, or walk in the very streets of the villages. I recollect having caught some in a stable at Henderson where they had followed some wild turkeys. In the course of the same winter, a friend of mine, who was fond of practicing rifle-shooting, killed upward of forty in one morning, but picked up none of them, so satisfied with grouse was he as well as every member of his family. My own servants preferred the fattest flitch of bacon to their flesh, and not unfrequently laid them aside as unfit for food.' Twenty-five years after, the same author says: 'Such an account may appear strange; but in that same country where twenty-five years ago they could not have been sold for more than one cent a piece, scarcely one is now to be found. The grouse have abandoned the State of Kentucky, and removed (like the Indian) every season farther westward to escape from the murderous white man.'"


MEADOW-LARK (*Sturnella magna*).

The bird above mentioned was once probably very abundant in all the southern New England States, but is now only found in small numbers on Martha's Vineyard and one or two other islands off the southern coast of Massachusetts, being entirely extinct on the main land of New England.

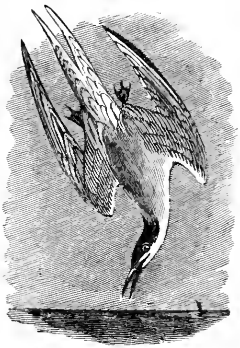
Mr. J. A. Allen says: "The mammalian and bird faunæ of all the older settled parts of the United States are vastly different from what they were two hundred years ago. These changes consist mainly in the great decrease in number of all the larger species, not a few of which are already extirpated where they were formerly common. A few of the smaller species of both classes have doubtless increased in numbers. Many of our water-fowl that are now only transient visitors, — as the Canada goose, the several species of Merganser, teals, black duck, and mallard, — undoubtedly once bred in this State (Massachusetts), as did also the wild turkey and prairie hen." An old farmer of Essex County recently told us that fifteen years ago the passenger-pigeon was accustomed to breed in considerable numbers in a forest not far from his house. Now a few pairs may be seen in the spring and fall migrations; but none in the summer. In the same county, ten years ago, the ruffed grouse was quite abundant; but now it is rare that any are seen except in the deepest woods, and then only an occasional pair, most of them having been snared, and sent to the Boston market, laws to the contrary notwithstanding. Formerly some six or seven species of sea-ducks bred among the islands of Massachusetts; now none are to be found except the dusky-duck, and that in no great abundance.


WHITE-WINGED CROSSBILL (*Curvirostra leucoptera*).


AMERICAN SHRIKE (*C. borealis*).

**Increase of Insects.** — As a result of the decrease in the number of birds, we find that insects have been steadily increasing; and the aggregate loss through their agency is now

much greater than in former years. Since 1860, the damage done each year by such insects as the canker-worm, currant-worm, wheat-midge, Hessian-fly, etc., has been greater and greater; so that, in some sections, the cultivation of particular crops has been almost abandoned. New species of noxious insects are constantly being discovered by entomologists and others; while many species before unknown in this country have been introduced by the importation of plants, etc., from Europe. Insects that are abundant in the West are gradually working eastward, as the Colorado potato-beetle; and only earnest study and effort will prevent the continued increase of these pests of the land.



WILSON'S TERN (*S. Wilsoni*).

RAVEN.

There are about thirty species of insects which subsist on our garden vegetables. The grape vine has about fifty insect enemies; the apple tree seventy-five; our different shade trees some over a hundred; wheat and other grains fifty. The crop of wheat in the State of Illinois was injured by insects, in one year, to the estimated amount of seventy-three millions of dollars. The estimated annual destruction of property by insects in the United States is as high as four hundred million dollars. The effect of this loss is felt not alone by the farmer. It is to this, in a large measure, that many poor men owe their poverty; to this must be attributed the high price of farm produce and all healthy food, and the consequent increase of disease and want in our large cities. We do not hesitate to say that at least one-eighth of this loss by insects might be prevented by the careful protection and encouragement of birds; or, to put it in another way, the carelessness of the people in the United States in this respect costs them at least fifty million dollars yearly, besides much unhappiness and suffering.

MOTTLED SCREECH OWL (*Scopsasis*). (Raptores.)

HAWK-OWL (*Surnia ulula*). (Raptores.)

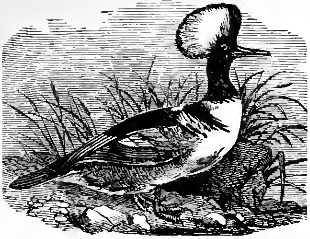
**How to Protect Birds.**—Of the measures for the protection of birds, perhaps the most important is the bird-law of Massachusetts (Acts of 1870, Chap. 304), which punishes by fine whoever takes or kills, sells, buys, or has in his possession, the birds named below.

Woodcock are protected between the 1st day of January and the 15th day of August; ruffed grouse (commonly called partridges), between the 12th day of January and the 1st day of October; quails between the 15th of December and 15th of October. Forfeits, twenty-five dollars for each bird above-named killed or sold out of season.

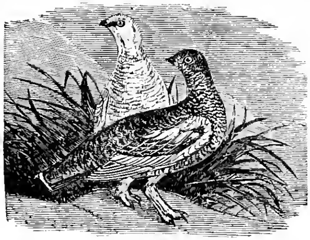
Pinnated grouse are protected till June 1st; wood or summer ducks, black ducks, and teals protected between 1st of March and 1st of September. Forfeits, twenty-five dollars for each bird killed or sold out of season.

Marsh and beach birds are protected between April 1st and July 15th; exceptions, snipe and plover. Forfeits, ten dollars for each bird.

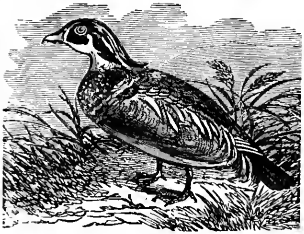
*All other birds, their nests and eggs* (except crow black-birds, crows, herons, bitterns,



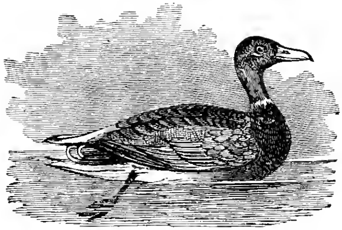
HOODED MERGANSER (*Lophodytes cucullatus*).



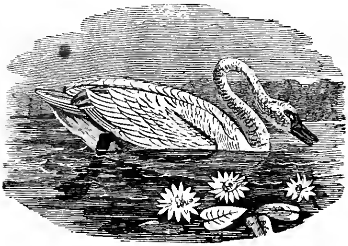
PTARMIGANS.



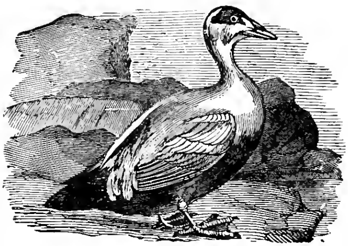
WOOD, OR SUMMER-DUCK (*Aix sponsa*).



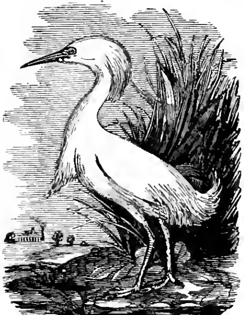
MALLARD DUCK (*Anas boschas*).



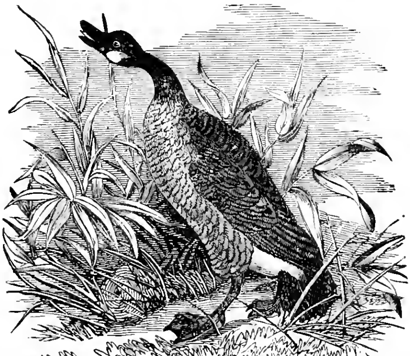
AMERICAN SWAN (*Cygnus Americanus*). (Natatores.



EIDER-DUCK (*Somateria mollissima*).



SNOWY HERON (*Garzetta candidissima.*) (Grallatores.)



WILD GOOSE (*A. canadensis*).

Canada geese, and water-fowl not previously mentioned) are protected through the year. Forfeit, ten dollars for each offence.

The State constabulary, mayor and alderman and selectmen of the several cities and towns of the Commonwealth shall cause the provisions of this law to be enforced in their respective places; and all forfeitures accruing under these sections shall be paid, one-half to the informant or prosecutor, and one-half to the city or town where the offence is committed.

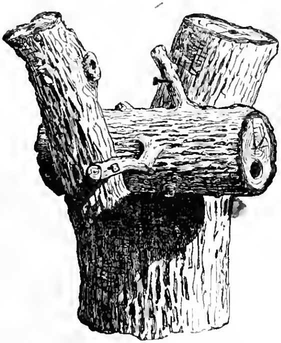
In itself, perhaps, no fault can be found with this law. It is only because it is not properly executed that it falls short of accomplishing its object. In the neighborhood of the large cities, it doubtless prevents some injury to birds: but in the small country towns we think it is very rarely that an arrest is made; and the selectmen are quite apt to look the other way to save the trouble of interfering with a neighbor or townsman. We have repeatedly seen strings of ruffed grouse, containing some dozens, which had been taken in abominable snares, being sent in to the Boston market from the small towns of Massachusetts. We believe it is still a common practice with many boys to make collections of birds' eggs, and to take not one egg only, but the whole nest, eggs and all, and shoot the parent birds, too, if possible. It is difficult to say how such things may best be prevented; but much good would be done, we are confident, if the selectmen would take the trouble to hunt up and punish a few cases which should serve as an example to others. Parents and teachers also may do much by way of precept aud example, and right-minded boys may do their part by influencing their companions to abandon so cruel a practice.

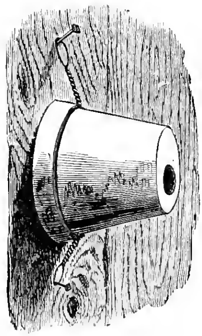
**Bird Houses.**—Next to the law, the most important measure for the protection of birds is the putting up of accommodations for them, and thus inducing them to settle on our estates. There is no reason why every one who has a half-acre of land should not have two or three pairs of birds nesting thereon. Perhaps many do not realize what simple accommodations swallows, bluebirds, wrens, and other birds, are eager to avail themselves of. Simple and inexpensive arrangements are just as satisfactory to them as the most elegant and costly ornamental houses; and no one need be prevented by fear of expense from furnishing dwelling-houses, rent free, to these interesting tenants. With a few simple tools and a box or two which any grocer will give you, a bird-house may be made of almost any size or shape desired. Should you wish it highly ornamental, nothing is better than to cover it with rustic-work, which may be done with the aid of a wild grape-vine cut in pieces of the right length and nailed on. Such a bird-house costs little or nothing save the time required to make it; and the slight expeuse will be amply repaid by the satisfaction of doing a good deed.

There are many simple contrivances which may be prepared and put up in five minutes, and will serve the birds as well as anything else. At the opening of the present season we put up four tin cans, such as are used for canning tomatoes, having first filed a small hole in the lower end to prevent the collection of water. Three of the four were immediately occupied by bluebirds. One pair laid five eggs, four of which hatched, and the young grew to maturity. The other two pairs each had two broods, four eggs to each brood, and all hatched; but three of the young died before growing up. Seventeen young bluebirds and their parents, six in number, twenty-three insect-eating birds, were thus induced to make their home in our orchard, the parent birds

for about five months, and the young, say about three months. Certainly, at a very low estimate, each bird would average twenty insects a day; for the food of these birds consists entirely of insects. At this rate the old birds would have destroyed during their stay here,

eighteen thousand insects, and the young thirty thousand six hundred, which gives a total of forty-eight thousand six hundred insects destroyed from our own and our neighbor's trees; and it did not take us half an hour to prepare and put up these simple accommodations. Are not these facts eloquent? Then how beautiful to watch the housekeeping arrangements of these beautiful little neighbors; to hear their welcome song when winter seemed still with us; to hear them debate the situation, and finally decide in favor of our apple-tree; to see

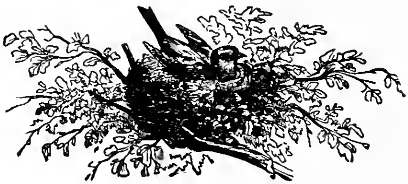




them carrying up the grasses and cotton and feathers, and weaving them together into a bed of down for the protection of their early-laid eggs; to watch their love-making, and all their gentle, affectionate ways towards each other; their jealousy of intruders, and their solicitous

care of their eggs during the period of incubation; their final joy when the young break the shells, and are born to the light; and their untiring devotion in obtaining choice bits of insect-food for the nourishment of their offspring. Truly here is beauty at our door-yard, and poetry has taken up her abode in our apple-tree. Purple martins and other members of the swallow tribe will readily occupy boxes put up for their use. Wrens, too, are interesting friends, and are easily induced to settle with us. We know of a case where a pair of bluebirds found a happy home in an old beaver hat which had blown up and lodged in an apple-tree. A good bird-house may be made of a medium-sized flower-plot, with the hole somewhat enlarged, and the top covered with a board. Will not every one who has a dozen rods of land make a bird-house of some kind, and thus help restore the proportions of the feathered and insect races?

We of the United States are considerably behind European nations in caring for and protecting insect-eating birds, and providing places for them to build their nests about our dwellings and gardens. The Swiss and French may perhaps be said to stand first as regards the protection of the smaller insect-eating species of birds, while the English, Scandinavians, and Germans are not far behind them in this respect. The myriads of ravaging insects with which the farmer has to contend in securing a crop in this country, show conclusively how little protection these ever-active little insect-gleaners have received from us in the past, and what may be anticipated in the future, unless better protection is given them from cruel and wanton destruction.



## PART VIII.

# A HIGHER STANDARD FOR THE FARMER.

**BUSINESS PRINCIPLES.**—Since all mankind depend for their sustenance, either directly or indirectly, upon the products of the soil, it follows, as a natural consequence, that a large proportion of the human race must ever be engaged in the pursuit of agriculture; and since the producers must not only provide for the wants of their own families, but for the non-producing population also, it will be found that the former will generally exceed the latter in numbers among any nation. This is especially true in our own country, where farming is the leading pursuit; yet, notwithstanding its great importance, when compared with other occupations, there is probably no kind of business practiced where so little system of keeping accurate accounts of debits and credits is followed as in that of the farmer. In fact, we doubt whether, if an accurate report were made, there would be found more than one farmer in ten who conducts the affairs of his farm on strictly business principles. As a result, for the most part, in agricultural economy as thus conducted, there are no definite means of knowing which crops are most remunerative, or which are at all profitable for raising, and instead of reliable data there is nothing except mere guess-work or approximate estimate. The excuse generally made by farmers for this lack of system is that keeping accurate accounts of debits and credits involves an expenditure of too much time and labor, or that it is but of little importance, and does not pay for the trouble. Now, what would be the result should the merchant, the manufacturer, or the banker conduct his business in the same manner? It is quite as important to the farmer to know the financial state of his affairs at all times, and the total amount of his receipts and expenditures for the year, as for a man engaged in any other employment, and he can no more afford to lose the benefit thus to be derived than can a merchant, manufacturer, or person engaged in any other occupation.

No business man whatever can carry on his trade or profession successfully, and have an intelligent knowledge of its condition, without keeping books and a careful posting of them in order to know the real condition of his affairs, and enable him to correct any errors in his mode of procedure; and this is the only way in which the farmer can have at all times a correct knowledge of his business. If no accounts whatever are kept of receipts and expenditures, the farmer will not be able to tell whether he is making or losing money, which are the most profitable crops, or what is the total amount of his possessions; without such an account, also, many losses may be sustained which might otherwise have been prevented. Besides, a record of dates, prices, etc., is a great convenience for reference, and many debts, loans, and charges that might otherwise be forgotten are more promptly attended to, and the farmer who is the most accurate in this respect is the most liable to be prompt in all his business arrangements, as well as more likely to keep out of debt. Book-keeping may be made very simple, and the small amount of time and labor required to keep the books in order may be taken in the evening after the work for the day is over, or at some other time from less important work. In order to keep an accurate account, all business matters should be taken note of immediately at the time of transaction. This may be done by means of a memorandum book or diary carried in the pocket, and a record copied in the day-book in the evening, each day's account thus being kept up to date. The books necessary for keeping farm accounts are a diary or journal, day-book, and ledger, or, as is sometimes done, the last part of the day-book may be used for a ledger; but it would be found much more convenient to have two separate books for this purpose.

**The Diary.**—In this book, which for farm use is generally of convenient size to be carried in the pocket, a record of each day's transactions should be made, including the labor performed, things purchased or sold, or other business, and all items of importance that it is

desirable to remember, with prices, dates, etc.; the records here to be sufficiently full to become, in a measure, a reference book from which the memory may be refreshed with regard to the principal data of the farm and household. It should be, in fact, the history of the work of the farm and the business life of the farmer. Making a note of the weather each day, and such items of interest as the receiving of friends by the family, or the leaving home of any member of the household, will also make it frequently valuable for reference.

**Day-Book.** — In this should be recorded each day, with dates and prices, everything spent for the benefit of the farm, which should be charged to it as debtor to that amount; while everything sold from the farm, being produced by it, should be credited to it. This book. for the average farmer, should contain from 250 to 300 pages, the pages to be ruled on the left in order to record the number of the page of the ledger to which the account is transferred; also two double columns on the right for dollars and cents. The usual method is to keep the debit account on the left hand page, and the credit account on the opposite (right hand) page. In this manner an accurate account may be kept with different fields or animals, if desired, as well as with individuals and farms. A field, for instance, would be debtor (Dr.) to the use of the land, the expense of the manure, tillage, seed, cultivation, harvesting, preparing for market, and marketing, or delivery at the place desired; and creditor (Cr.) by the amount of money received for that portion of the crop sold and the value of that which is used on the farm or in the household. A cow would be Dr. to her original cost, the interest on the money invested, and the expense of her keeping, and Cr. by the value of her milk and calves; a sheep Dr. to first cost, and interest on the money invested, and keeping, and Cr. by the lambs and wool, manure furnished, etc. When either page is filled, both should be added, and the different amounts placed at the bottom, when new charges and credits should be commenced on the next two pages.

The more accurate such accounts can be made, the more definitely will the figures, on balancing the account, show the real condition of the business. An able authority on the subject of keeping farm accounts says: "Sometimes we see accounts, even in agricultural reports, in which everything a farmer raises is set down at the market value. For instance, credit is given for the number of tons of hay, the number of bushels of corn and potatoes, and everything that is raised, without a corresponding debit of what is used in keeping the stock through the year — making it appear as if the net income was very large, when, in reality, nearly all is used upon the place. A farmer may, perhaps, plow large fields that have been previously manured, and, without applying any fertilizer, obtain a good crop, which, when sold, brings in a large sum of money. He may decide that his profits are large; but a system of book-keeping that estimates the value of the land of each field, each year, would oblige him to appraise the fields from which his large crops were taken as of less value than before. This would show him that the profits were not really as large as he at first supposed. Another might spend a good deal of time and money in making improvements, which, for the present, bring in no profit, and it might seem that nothing was made by farming; yet an account of what his improvements cost, and of all that the land (on which the improvements were made) produced for several years, would change his mind. Thus, by carrying out a system of book-keeping which not only applies to the farm as a whole, but also to each operation in detail, a very large fund of practical knowledge would be obtained in a few years. If each farmer in our nation would thus estimate the expenses of his business, our practical knowledge of the value of agricultural products would be increased, and the amount of productions in the country be vastly enlarged."

**Ledger.** — Whatever system of keeping accounts is followed in the day-book, a ledger should be kept, since it will be a great convenience in representing at a glance the real status of the business, the results of the transactions recorded in the day-book being transferred to its pages. Thus are brought together in a compact form all the transactions which may be had with a single individual, being collected from the various pages of the day-book — perhaps representing several months of time — and arranged in a systematic manner. The ledger should be so ruled that the Dr. and Cr. accounts with a person can be kept on a single page, the Dr. occupying the left hand side and the credit the right, thus showing at a glance the state of the business affairs; thus, if we transact business with A, and the Dr. side of the ledger exceeds the Cr., showing that A owes us more than we trust him, the balance is so much in *our* favor; but if it shows that the Cr. side exceeds the Dr., then we owe him more than he trusts us, and the balance is in *his* favor.

Every six or twelve months all the accounts in the ledger should be balanced by adding

all the Dr. and Cr. columns, and subtracting the smaller amount from the greater, and employing the remainder as the beginning of a new account. The ledger should have an index at the commencement, with the pages containing the transactions with different individuals plainly numbered. An inventory should be taken by the farmer of his property once each year, including land, buildings, live stock, farm produce on hand, agricultural implements, cash on hand, dues, or unsettled accounts; in fact, every thing of money value which he possesses. In doing this, the different kinds of property should be specified, together with the money value of each. This should be done at the beginning of the year or first of April. He should also find the amount of his liabilities, which will include all borrowed money and debts of every kind, and such a proportion of his taxes, interest, and insurance as may be due at the time of making the inventory. If the inventory exceeds the liabilities, the difference between the two sums shows how much the man is really worth; but if the liabilities exceed the inventory, the difference indicates how much the individual is in debt, or the excess of his liabilities beyond his means. Thus a comparison of such accounts year by year, or oftener if desired, will show the farmer whether he is making or losing money, and the precise amount, as well as the present value of his possessions.

**Insurance.** — Since all persons are liable to calamities of one kind or another, either to themselves physically by accident or by loss of their property by fire, it may be well for every farmer to consider the benefits to be derived from the partial remedy which insurance affords for such ills. Although insurance cannot extend the life of an individual, or prevent accident or calamity to himself and property, yet it affords, to a certain extent, either to the person insured or to his family, protection against some of the evils resulting from such events. The three principal forms of insurance in which the farmer might find especial interest are life, fire, and accident insurance. Life insurance, when secured with a reliable and trustworthy company, is a safe and easy method of providing for the family or friends of the person insured in case of his death.

In life insurance the managers of the insurance company take their risk of paying the policies of those they insure in case of their death, knowing that according to the usual mortuary records some of their members must die each year. Those of the policy-holders that live can make the requisite payments without much sacrifice, which payments go in part to pay the policies of those that die, and thus aid the families of the latter. When a policy-holder dies his family receives from the insurance company the sum for which his life was insured. In many years the policy-holder pays a considerable amount for his insurance, but rarely as much as his policy will amount to when he dies.

Fire insurance covers the risk of the destruction of buildings, furniture, and clothing from fire. While taking this risk the insurance company granting the policy requires that certain precautions shall be taken against fire, and unless the precautions or rules are observed the policy is annulled. In order that the owner of property insured shall not be tempted to destroy it by fire, insurance companies never insure for the full value, but generally from one-half to three-fourths of the real value of the property, and will pay all just and honest claims embraced in their various contracts.

Accident insurance is based upon about the same principle as life insurance, the expense of the policy being proportioned to the risk to which the person is exposed. The expense of a policy of this kind is generally less than either life or fire insurance, and it secures to the individual holding it a stated weekly allowance during the period of entire disability from accident, if the time does not exceed six months, or the payment of a certain sum to his family, providing the injury proves fatal. We are well aware that during the past few years many insurance companies have proved themselves unworthy the confidence of the public, much to the loss and disappointment of their patrons, but we must remember that these, when compared with those that are reliable and trustworthy, are very few in number, and the fact of there being any such does not argue at all against insurance or the principles upon which it is founded. The coins of purest gold may be counterfeited, but this does not prove that there is no pure gold. Before obtaining a policy of insurance of any kind, or of any company, however, it would always be best to obtain all the reliable information concerning its trustworthiness possible.

**False Economy.**—While true economy should be practiced by all, and ever brings its own sure reward, many grave errors are committed, and worse than needless sacrifices are constantly being made in its name. Without economy one of the principal elements of success in life is wanting; while with it, other conditions being equal, a person is almost sure

to succeed. True economy has been defined as using things to the best advantage, while false economy is the reverse, and is but another name for penuriousness and mismanagement in some of its forms, of which there are many. The farmer who thinks he cannot afford to purchase books and take papers which are especially designed to assist him in his occupation, or who continues to use hand power in his work where the machine could be much more profitably employed, is practicing false economy to the detriment of his business and himself individually. In all kinds of business "knowledge is power," and he who possesses it has one of the great elements of success; yet how shall he possess knowledge without obtaining it in a great measure from the experience and investigations of others. To be sure, one may experiment for himself in a small way, and may derive much benefit by this method, but his own experience must of necessity be limited, requiring time; and how much greater advantage would be derived, if in connection with his own researches he should be able to command the use of the knowledge derived from the investigations of those who have made a specialty of such subjects. What would be thought of the mariner who should attempt to cross the ocean without a compass because he thought he could not afford to purchase one, or a lawyer or physician who attempted to practice their respective professions without the aid of books giving instruction on the topics pertaining to them?

Other methods of practicing false economy might be embraced in the keeping of inferior breeds of stock, or if the herds are such as are desirable, keeping them in a poor condition; the purchase and use of inferior tools, allowing the farm-buildings to become dilapidated, without making the necessary repairs; letting things run to waste generally for lack of time or funds to attend to them; buying necessary things for use on the farm and in the family in small quantities, thus losing the advantage to be derived from the commission off to be saved when making a purchase of a considerable quantity, besides the convenience of having things constantly on hand; buying goods on credit instead of for cash; growing unsuitable crops; buying things which might easily be grown at home; borrowing tools; hiring tools mended when they could be mended at home just as well, and at no expense; keeping the children home from school to work and allowing them to grow up in ignorance when they should be acquiring an education to fit them for future usefulness, all of which are too frequently seen and practiced under the mistaken impression that by so doing the best interests of economy are thus subserved.

**Education.**—The advantages to be derived from a good education can scarcely be overestimated, and a cultivated mind is just as beneficial to the farmer as to persons engaged in any other pursuit. It is frequently the case that the boys from farmers' families who are intending to follow some professional or mercantile business are allowed special educational advantages, but those that follow the profession of farming (for farming is one of the noblest and most honorable of professions) are permitted to have but limited privileges in this respect. Education is a power in any department in life, and it is quite as essential that the farmer should be able to utilize this power in order to attain the highest success in his calling as the lawyer, the physician, or the merchant; and the better his education, together with the ability to appropriate this power to its best uses, the more successful the farmer, as a general principle. Professor H. E. Alvord says in this connection: "The farmer must apply to himself, and to the son or sons to succeed him, a standard similar to that by which he measures the qualifications of his doctor and his minister. It is unfortunate that farmers are so slow in doing this. No one ever heard of a physician fresh from his schools and books being sneered at as a 'book-doctor.' On the contrary, all doctors without a complement of book-learning, scientific training, are shunned and denominated 'quacks.' Yet very recently it was common for farmers of the olden style to look with pity, if not suspicion, upon those who studied agriculture as a science and undertook its practice with a progressive spirit, and to call such 'book-farmers.' Happily such errors are passing away; book-farmers, well educated farmers, are making themselves felt; winning respect and finding an appreciation of their enterprise. Let us hope the time is not distant when book-farmers, in the best sense, shall be in the majority. Then, perhaps, 'quacks' will be found in farming. The fact is, at present quack-farmers are too plenty and book-farmers too few.

Book-farming, in its truest sense, is only making use, in addition to one's own experience, of the experience of others, as recorded by them on the printed page. And these others are often men who have been able to give much more time to the study and practice of special branches of agriculture than it will ever be possible for us to do. If the books be only on subjects where we need light, and their authors known as competent to give it, the more we have within reach, and the more we study them, the greater becomes our store of

*experience* of that experimental knowledge which, whether of our own obtaining or procured from others, is so necessary in guiding our footsteps every day we live.

In every farmer's home there should be good books on the various branches of scientific and practical agriculture, which give us the benefit of established facts; and good periodical journals and newspapers should be coming in to bring the latest intelligence and experience in all farming operations. More important still, a *taste* for this class of useful reading should be cultivated by the farmer himself and formed in his family by precept and example, to the exclusion of the raft of stuff which goes under the name of literature, but which serves only to assist in wasting precious hours.

A demand has arisen, and is increasing, for a higher education for farmers, and the next question is, of what shall it consist? When one comes to consider or describe a comprehensive agricultural education a big subject is presented. Agriculture is at once a science and an art. 'Practice with science' is, therefore, a good precept for its student, and it is well to keep fresh Davy's excellent definition of science as 'refined common sense" The educated farmer must be able to keep pace with the advance of modern science and discern wherein its developments may be brought to his aid. He should be a better chemist than his doctor or his druggist, a better botanist than either, and should be acquainted with geology, mineralogy, entomology, and somewhat with meteorology. He should be as good a business man as his grocer or his banker; especially he must know how to buy and to sell. He must understand the physical powers, know the value and strength of materials, and be a pretty good mechanic, if not an engineer. He should be able to do plane surveying and leveling and to manage a microscope. A farmer needs as accurate knowledge of anatomy and physiology as a physician, though it be in a different and wider field; he needs to be something of a lawyer, to know what trees he may cut, and when he may shoot a woodchuck or take a trout on his own farm,—and he needs a fair share of his minister's theology and faith to fully appreciate the mysteries and the beauties of creation, the grandeur of nature and natural laws, and to truly love and honor the vocation which, above all others, brings man into close communion with God. In short, it is safe to assert that no human occupation requires so long a course and wide a range of study to fit a person comprehensively for its intelligent and profitable pursuit as agriculture. There is, besides, the necessity of practice, or the apprenticeship part of learning the art.

This presentation of the subject should not discourage nor alarm. There are partial courses and short cuts to successful special farming as well as to the bar and the pulpit. A half loaf is better than no bread, and in some cases does as well as a whole one. We are not considering the training needed to make a plowman, or a teamster, a mower, or milker, or ditcher, but the making of a farmer, in the broadest sense. Education requiring time and money, and ambition and brains, solid, substantial study and drill, will be meat and bread to the farmers of the next century, and of these many are now alive.

If the question anywhere arises which of three boys on a farm shall be given the advantages of a collegiate or technical education, the one who is to be a professional man, the one who is to go into business, or the one who is to be a farmer, there is no sort of question in my mind that the future farmer is the one who needs special education the most, and a good agricultural school or college is the place to get most of it."

When we compare the old methods of agriculture practiced by past generations, and the results obtained, with those of the most enlightened and scientific farmers of the present time, we can more fully realize that the old were based upon ignorance, and to some extent superstition, and the new upon science and practical knowledge; and he who adheres to the old and ignores the new, must expect to be left in the rear, as far as progress and successful results are concerned. The farmer should have a special knowledge of his business, embracing an understanding of the nature of different soils, the agricultural value of different manures and fertilizers, and their adaptation to different soils and crops; the best methods of tillage and cultivation adapted to different soils and plants; the principles of breeding, care, and general management of farm animals, together with a thorough understanding of all the various other departments of agriculture, of which there are but few. Besides this, the farmer should possess a good fund of general information, and not be narrowed and limited to merely his business, however extensive or small it may be, for narrow-mindedness is to be deplored in any one, and a person of but "one idea", however good that idea may be, is as unpleasant to meet in the rural circle as any where else; besides, such an individual has not that capacity for usefulness and enjoyment in life, as one who is well informed on general subjects, and such information as is derived from the reading of the best books and newspapers, attending Agricultural societies, lectures, farmer's clubs, access to public libraries, attending and partici-

pating in the debates of lyceums, where the topics of interest on general or special subjects are discussed, etc., all of which are highly educating in their influence, and in very many instances have been made to well supply the deficiency of educational advantages in the earlier life of individuals.

**Form of Constitution Suitable for a Literary or Debating Society.**—The following form of a Constitution and By-laws, adapted to a literary or debating society, and copied from the records of a society of this kind, may be found convenient as a model or guide in general outline, in the formation of such societies. Of course, this form is not intended as a model to be *implicitly* followed, but as a form to be modified or deviated from to suit the circumstances.

## CONSTITUTION,

Of the ——— Society of ——— (name of city or town, and State.)

### PREAMBLE.

We, the undersigned, do declare ourselves an Association for mutual improvement in Elocution, Composition, and Debate, and for enlarging our fund of general intelligence: in the pursuit of which objects we desire to exhibit a due consideration for the opinions and feelings of others, to maintain a perfect command of temper in all our intercourse, to seek for truth in all our exercises—and have adopted for our government the following *Constitution*.

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## CONSTITUTION.

### Article I.—Name.

This Association shall be known by the name of the ——— Society.

### Article II.—Officers.

The Officers of the Association shall consist of a President, a Vice-President, Recording Secretary, Corresponding Secretary, and Treasurer, who shall constitute a Board of Directors; also two Tellers and an Editor.

### Article III.—Officers' Duties.

*Section* 1. It shall be the duty of the President to preside at all meetings of the Society, to enforce a due observance of the Constitution, By-Laws, and Rules of Order; to decide all questions of order, offer for consideration all motions regularly made, apportion duties two weeks in advance, call special meetings, appoint all committees not otherwise provided for, and perform such other duties as his office may require. He shall make no motion or amendment, nor vote on any question or motion, unless the Society be equally divided, when he shall give the casting vote.

*Sec.* 2. In the absence of the President, the Vice-President shall perform the duties of that officer, and shall be Chairman of the Board of Directors.

*Sec.* 3. The Recording Secretary shall keep in a book, provided for the purpose, a record of the proceedings of the Society; also a record of the name and residence of each member, showing when he was admitted, and when he died, resigned, or was expelled; keep a record of the subjects debated, the disputants, and the decisions of the Society in a separate book, and shall have charge of all books, documents, and papers belonging to the Society.

*Sec.* 4. The Corresponding Secretary shall notify absent members of their duties for the two succeeding meetings, also each person elected a member, of such election, and shall write all communications.

*Sec.* 5. The Treasurer shall receive all moneys belonging to the Society; keep an account of all dues and fines, and of all receipts and expenditures; notify each member monthly of his dues and fines, and collect the same; and shall call the Roll at the opening and close of each meeting. He shall report the state of the Treasury whenever required by a resolution of the Society, and shall make no payments without a written order from the President, and countersigned by the Recording Secretary.

*Sec.* 6. The Editor shall copy, and arrange in a collected form, all communications received by him, excluding such as may be deemed by him unpleasant personalities, or otherwise unsuited to the time and place, and shall read the same at every alternate meeting of the Society. He shall maintain secresy concerning the authorship of all communications, and insert them without addition or alteration. Such periodical shall be called the ——.

*Sec.* 7. The Tellers shall canvass the votes cast at all elections; shall immediately make known the result of same, and render a true written report at the meeting following such election.

*Sec.* 8. The Board of Directors shall be a Standing Committee to manage the affairs of the Society, holding meetings at least once a month. They shall decide upon all questions of debate offered in the Society, and shall examine and inquire into the standing of all persons proposed for membership, and at the next regular meeting report the result to the Society, who shall determine upon their admission.

*Sec.* 9. The Board of Directors and Treasurer shall present to, and read before the Society, reports at the expiration of their terms of office.

### Article IV.—Election of Officers.

*Section* 1. All Elections for Officers shall be held at the last regular meetings in June and January. The term of each shall commence at the meeting following his election. In case of a vacancy occurring in any office, the Society shall go into an immediate election to fill the same, and the officer elect shall take his seat immediately after such election.

*Sec.* 2. All elections for officers shall be made by ballot, and shall be determined by two thirds of the votes cast.

### Article V.—Membership.

*Section* 1. Any member may propose a person for membership at a regular meeting, by giving his name, residence, and occupation, and after being reported upon by the Board of Directors, the Society shall determine his admission by a three-fourths vote of the members present.

*Sec.* 2. Any person may be elected an Honorary Member of the Society, by a unanimous vote at a regular meeting. He shall be entitled to all the privileges of a member, except holding office, or voting upon any question or motion, and shall not be fined for absence, nor called upon for the initiation fee or dues.

### Article VI.—Amendments to Constitution, etc.

Every proposed alteration, amendment, or addition to this Constitution, By-Laws, and Rules of Order hereunto annexed, must be handed to the President in writing, who shall publish the same to the Society, and at the next regular meeting, it shall be adopted by a two-third vote of the members present.

### Article VII.—Order of Business.

A motion to change the Order of Business, or to postpone the performance of the regular duties, shall require, for its adoption, a vote of two-thirds of the members present.

### Article VIII.—Suspension of By-Laws.

A By-Law or Rule of Order may be suspended in case of an emergency, by a two-third vote of the members present, but only for a single evening.

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**Social Life in the Country.**—The meagreness in social and intellectual influences, as compared with most occupations, that is commonly found in farming districts, is one of the grave objections made against farming as an occupation. The pursuit itself, as commonly carried on, does not bring the farmer in contact with other minds, as does that of the merchant, the lawyer, the physician, the mechanic, etc., a contact which has a tendency to develop the social element in a man's character. In most farmers' houses there is a comparative isolation of each household, which becomes to a certain extent a little society or world of its own, while the farm-house with its surrounding out-buildings stands conspicuous in its independence, and may be compared to a feudal castle in the midst of its dependent cottages, giving a peculiar charm to country scenes. Farmers and their families are also so busily occupied, that they seem to find little time for social recreation;

they work too hard, read too little, think too little, and do not spend sufficient time in social culture; consequently they make life a drudgery, and its object the gaining of dollars and cents, while their intellectual culture is in many cases sadly neglected. Going so seldom into society, it happens in many instances that they finally come to have an aversion to it, and feel awkward and out of place when in the society of well educated and refined people. Now there is no reason for this; the fault is in the *farmer himself*, and not in his business; his occupation, if rightly considered, does not debar him or his family from intellectual enjoyment, or the advantages of the refining influences of social life; it is self-imposed, and in time becomes a habit so confirmed that it seems difficult to break, and soon becomes to be regarded as a necessity. The farmer's occupation is one that is ennobling and elevating, and there is no reason whatever why those who till the soil or have the management of farm animals should not experience the refinements which are the result of mental culture, and formal social life, or should not feel perfectly self-poised and at ease in the parlors or assemblages of the most refined and cultivated people in the world. If the farmer would take advantage of the facilities afforded by advanced agriculture, and keep abreast with the age in which he lives, employing the best implements in the performance of his labor, the most approved methods of practice, together with all the aids to be derived from the reading of the best books and papers on agricultural topics, there would be a great saving of physical strength and time, and larger profits, thus affording more opportunity for cultivating the mind and enjoying the influences of refined social life. It does a farmer good to doff his business bargains in the pursuit of dollars and cents, his farm talk of crops and cattle, with his working garb, and in his best attire mingle with a motley company of his neighbors, —men, women, young men, and maidens, for a pleasant recreation.

Such contact with other minds has a refining influence, it rounds off the sharp corners and idiosyncrasies of an individual's character, polishes off the rough surfaces, and makes him feel better satisfied with himself and the world around him, while he thus naturally falls into the ways of an intuitive kindness, which is, in fact, the truest politeness, the doing to others as he would that they should do to him; thus a more genial and refined manner is unconsciously developed. If a person is naturally morose, pleasant, refining society is one of the best means of dissipating that tendency. In attempting to please and entertain others, one is himself pleased and entertained, and after an evening spent in pleasant social converse retires with many of the rough asperities of his nature considerably toned down. This influence remains for a few days, and would be permanent, if it could be occasionally re-enforced by such participations, the result being most agreeable and useful. A person can be more useful to the world and to himself, be a better and happier man, for enjoying the refining influences of social life. If farmers generally would work less, and spend more time in improving their intellectual and social faculties, they would live longer, be more useful and happy, and more successful in their business. A knowledge of the common courtesies observed in the best society is a great benefit to every one, young or old, and has a tendency to make a person feel self-poised and at ease under all circumstances, besides making one appear at better advantage in society, since it relieves from all embarrassment and awkwardness.

Such information can only be obtained from reading and coming in contact with cultivated and refined people. Farmers should be interested in all that pertains to public improvements, and the social elevation of the town in which they reside. Ignoring these things, and they ignore the best interests of themselves and families. Every country town ought to have a public library of choice reading. Even though small in the number of its books and periodicals, let them be wisely selected, and the number can be generally enlarged every year. Such an institution, properly managed, has a wonderfully educating and refining influence upon a community. Stated social gatherings, literary societies, lyceums, with perhaps an occasional lecture, are also educating in their influence, and this is an admirable way of spending one or two evenings of the week in winter, or at other times when the season is such as will admit.

**Character.**—The term character and reputation are very apt to be confounded. Character might very properly be defined as *what the man really is;* and reputation, as *what others say he is;* hence, a person's reputation is not always (although generally) an index of his true character. For instance, a person may be maliciously misrepresented, misunderstood, or through lack of appreciation in others, not enjoy that good reputation which his character merits; while on the other hand, his qualities may be so over-estimated, and such a false value set upon them, that he may have a far better reputation than his true character, if

known, would warrant. Only an individual's own actions can affect his character; it is what the man *really is* that enstamps that, and not what men *say* he is. It should be the aim of every one to establish a good reputation, for no one should be indifferent to public opinion. yet the desire of possessing a good reputation should never conflict with our ideas of right, our moral principle, and cause us to sacrifice the latter to obtain the former. Conscience and duty to God and man should be the standard of guidance in life, rather than public opinion. Whoever pursues such a course quietly and persistently will generally be appreciated and respected among his fellow-men; bnt if not, he will have the satisfaction of an approving conscience in doing right as far as he understands his duty.

A truly noble nature will generally be recognized as such by those of a similar character; and eventually, if not speedily, will the sincere endeavor to do right be fully recognized and appreciated in every one. In order to secure a good reputation, a person must be honest in intent and deed. "Honesty" will ever be found "the best policy" in every department in life, yet the truly honest course should be followed because it is *right*, and not from motives of policy, or for the hope of the reward it may bring. The farmer who always furnishes a good article to the market, and never practices the many petty devices frequently resorted to for making products appear to be of better quality or of larger quantity than they really are, will soon establish a reputation for honesty and fair dealing that will be a great aid in securing good prices and custom for his products. The financial advantage to be derived from strictly fair dealing, and a good reputation, may, however, be regarded as incidental, and are not to be considered at all in the light of a motive. Deceit and trickery may prove successful for a time, but eventually they will be detected, and will result in failure of success in the end. A strictly honest man will be honest in every department in life, and his character be free from all stain. An immoral man cannot be justly regarded as an honest man, and should never be trusted as such in business transactions, for if he would prove false and recreant to the most sacred relations in life, and by his influence, debase rather than elevate humanity, he is not to be safely trusted in minor matters involving financial interests; while he whose life is guided by strictly moral principle, and what is better, Christian principle as well, will be universally respected and trusted when his true character is known, and has in his possession one of the highest elements of success.

**Penuriousness and Extravagance.** — It has become somewhat proverbial that penuriousness is the common fault of farmers. Whether this may be true in a general sense, it is certainly a fact, that too many farmers carry what they regard as a necessary economy to excess, and which in the farmer himself, his wife, and his children, amounts almost to the sacrifice of martyrdom, every dollar and cent that can be saved from the bare necessities of maintaining an existence being hoarded up and put in the savings bank, government bonds, or expended in the purchase of new land, while every waking hour is spent in the hardest kind of drudgery in order to eke out, if possible, a few more dollars to add to the hoarded treasnre. In such a household we see none of the pleasant adornments that add so much to the beauty and attractiveness of the home; there are few, if any, books and papers; only the bare necessary articles of food are found upon the table, while the furnishings of the house and the clothing of the inmates are of the most meagre character, all the common comforts and enjoyments of the home being sacrificed for the purpose of laying up a few more dollars. It is no wonder that children leave such a home as soon as they are old enough, and do not remember it in after life with pleasure. Such penuriousness will be found the poorest economy in the end.

The opposite extreme will be found in extravagance and wastefulness, which are sometimes very improperly regarded as liberality and true generosity, both of which extremes should be equally avoided. True economy may not be incompatible with the gratification of necessary and specific wants, but the spending of money for unnecessary things which we may want, but cannot afford to purchase, is extravagance.

**Temperance.** — In the economy of life, the temperate use of things is the safest, and, therefore, the wisest method of procedure. The practice of drinking spirituous liquors as a beverage is a *great evil*, — one of the greatest with which our country, as well as the other nations of the world, are cursed, and if young men realized as they should the fatal snare into which they enter when they commence forming this habit, they would shrink from it with abhorrence. We believe in the use of alcoholic liquors as a medicine when no equivalent can be found to answer the purpose, but that they should be used sparingly and only when necessary, the same as all medicinal drugs. Even a moderate use of liquors is injurious, not only because

it will almost inevitably lead to excess, it being difficult for most persons to draw the line between a moderate and immoderate use of it, but from its evil effects directly upon the whole system, especially upon the nerves and heart. Dr. N. B. Richardson, one of the most celebrated physicians of London, states that he was able to convey a considerable amount of conviction to a man who thought he could not get along without his regular daily rations of alcoholic stimulants. He did this by showing him the effects of alcoholic liquors upon the action of the heart.

He says: "I said to the man, will you please feel my pulse, as I stand here, counting it carefully. What does it say? He did so, and replied, 'Your pulse says 74.' I then sat down in a chair and asked him to count it again. He did so, and said, 'Your pulse has gone down to 70.' I then laid down on the lounge and said, will you take it again? He replied, 'Why, it is only 64; what an extraordinary thing!' I then said, when you lie down at night, that is the way nature gives your heart rest. You know nothing about it, but that beating organ is resting to that extent; and if you reckon it up, it is a great deal of rest, because in lying down the heart is doing ten strokes less a minute. Multiply this by 60, and it is 600; multiply it by eight hours, and within a fraction it is 5,000 strokes different; and as the heart is throwing six ounces of blood at every stroke, it makes a difference of 30,000 ounces of lifting during the night. When I lie down at night without any alcohol, that is the rest my heart gets. But when you take your wine or other alcoholic drinks, you do not allow that rest, for the influence of alcohol is to increase the number of strokes, and instead of getting this rest, you put on something like 15,000 extra strokes, and the result is, you rise up very nervous and unfit for the next day's work till you have taken a little more of the 'ruddy bumper,' which you say is the soul of man below. His wife acknowledged that this was perfectly true. He began to reckon up those figures, and found what it meant lifting up an ounce so many thousand times, and the result was, he became a total abstainer. with every benefit to his health, and, as he admits, to his happiness. I would like those who take stimulants to give them rest, just to take the opposite side of the question into consideration, and see how the two positions fit together."

Young men are apt to entertain the foolish idea that in taking an occasional drink they are exhibiting a spirit of manliness, so ape their elders in this respect, the same motive prompting that induces them to smoke their first cigar; but when the habit is once formed, it is with difficulty broken, and too often proves a chain of such power that it seems impossible to sever it, and the victim is dragged by it down to a drunkard's grave. The only safe and manly course for a young man to pursue is to entirely discard the use of all alcoholic liquors; to shun the evil as he would a deadly viper, and not allow himself to become contaminated by its influence, as he certainly will more or less, if he partakes of it.

**Adulteration of Liquors.** — When we consider the evil effects upon the system of a frequent use of pure alcoholic stimulants, and the additional fact that the great proportion of liquors sold in this country are adulterated with poisonous drugs, it is no wonder that the army of men that yearly fill drunkards' graves is so large; the only wonder is that some of them survive as long as they do! The following report concerning the adulteration of liquors was obtained from an extensive wholesale liquor dealer in the city of New York, many years engaged in the business, and who has recently retired from it. On being requested to state the manner of adulterating liquors, he replied:

"If I should give you the tricks of the trade with my name, this city would be a hot place for me. But few liquor drinkers have the faintest idea in regard to the extent of the evil of adulteration. For instance, more than two-thirds of the stuff sold for brandy in this country is the meanest kind of poison. It is manufactured from an oil of cognac. Dr. Cox, the inspector of liquors for Ohio, after examining some of these imported brandies, said that the chemical tests gave him fusil oil as a basis, with sulphuric acid. copper, chloroform, tannic acid, Guinea pepper, and a small percentage of good brandy. The same gentleman, after testing liquor from a half pipe of 'splendid Seigrette brandy,' found evidences of sulphuric acid, nitric acid, nitric ether, prussic acid, Guinea pepper, fusil oil, and common whiskey.

Gin is considered a safe drink by thousands, who believe that it is the only liquor which escapes adulteration. They are mistaken. In most of the gin sold, there will be found oil of vitriol, oil of turpentine, oil of almonds, sulphuric ether, and extract of grains of paradise. It is in the manufacture of whiskey, however, that the adulterators do their finest work. You can purchase oils and essences from which 'whiskey of any age' can be produced. The style of whiskey when tested will show sulphuric acid, caustic potassa, benzine, and nux vomica, and other poisons. This is the sort of stuff that bores into the coatings of the stomach and cre-

ates ulcers. The adulterated stuff is murderous. In porter you will find opium, henbane, capsicum, cocculus indicus, copperas, tobacco, and sulphuric acid. In beer, alum, opium, nux vomica, green copperas, vitriol, sub-carbonate of potash, and jalap are used. Of course, ale of this character is dangerous to drink. If you don't believe me, drop in at any of the beer shops near the wharves of the East or North rivers and drink one of their 'schooners' that are sold for five cents. If it does not produce complete nausea it will surely cause intoxication. Cocculus indicus is used largely in this kind of beer. It is used to give strength to the beer. It is a small berry, very bitter, and of an intoxicating character. Three grains will produce nausea and intoxication; ten grains will throw a strong dog into convulsions. Now you can understand how strong men, after drinking beer dosed with this poison, lose for a time all power of locomotion. Fox-glove and henbane are used for about the same purposes as cocculus indicus. Jalap is used to offset the astringent qualities of acids. Oil of vitriol is used to increase the heating qualities of liquor, wormwood is used for its bitter and stimulating qualities, green copperas gives porter a frothy 'head,' and the drinker as well. Slacked lime is also to be found in adulterated porter.

We see very little of any kind of wine that is pure in this country. The champagne district in France is not able to supply us with more than a tenth of the amount of wine manufactured there — the remainder being held for European nations. We import more alleged champagne than the champagne district produces, consequently we get a bogus wine. Madeira is made here by extracting oils from whiskey and subjecting them to a chemical process, in which carbon is the principal agent. In astringent wines you find alum, Brazil wood, oak sawdust, lead, and copperas. Sugar of lead and arsenic are also used in wine. In the manufacture of one brand of Port, the washings of brandy casks, coloring made of elderberries, logwood, salt of tartar, green dragon, and tincture of red sanders are used. In pale sherry sulphuric acid, prussic acid, and alum are among the 'harmless ingredients' used to give color and the appearance of age.

As to lager beer, I don't suppose that there is a solitary brewer in New York who will have the hardihood to claim that he sells genuine lager; I doubt if a sale could be found for it. Why? Because pure lager loses its head, looks flat almost immediately upon being exposed to the air. The froth on beer which finds ready sale is produced by artificial means. I do not suppose, however, that lager is as dangerous to drink as other adulterated liquors, although I know that at one time large quantities of tobacco stems were used in many breweries. I believe that tobacco is still used in the alleged lager sold at the rate of five cents a schooner."

**Use of Tobacco.**—Besides being an exceedingly filthy habit, the use of tobacco in any of its forms is very injurious, the effect of tobacco upon the animal system having been carefully and critically studied by experimenting with nicotine (the oil of tobacco) upon animals, it being a deadly poison, and one of the most powerful nerve poisons known, the effect being tetanic convulsions followed by paralysis, and death through failure of respiration. The pulse is at first lessened and afterwards quickened, and the pupil of the eye contracted. The effect of tobacco can be very easily tested upon a toad or frog. By moistening a small quid of tobacco and placing it in his mouth death will ensue in a very short time. In man, when taken in sufficient quantity to show poisonous effects, tobacco produces giddiness, faintness, intense nausea, followed by vomiting and great feebleness, and general relaxation of the muscular system, as many a young man has experienced when first commencing to smoke or chew. The skin becomes pale and moist and the pulse feeble. If taken in sufficient quantity these symptoms would be greatly intensified and even cause death. Extensive internal application of tobacco will also cause death, as has been known in cases of young lambs and calves being washed in too strong a decoction of it in eradicating ticks and lice. The effect of tobacco upon different persons differs according to the temperament, their susceptibility to poisons, etc., habit making a vast difference with regard to the effect of the dose, the same as with opium, arsenic, and other poisons. A dose taken for the first time might be sufficient to cause death, which if taken after the habit were gradually established might produce no visible effects whatever. Dr. E. Curtis states as follows respecting the effects of the continued use of tobacco upon the system: "Chronic poisoning by tobacco, such as occurs from undue indulgence in the weed as a luxury, shows itself in dyspepsia, the smoker experiencing loss of appetite, especially in the morning, dry, foul tongue, and thirst; and in nervousness, as evinced by a general physical and mental restlessness, with undue susceptibility to external impressions, and by tremulousness of the muscles and palpitation or irregular action of the heart. With smokers, also, a form of chronic irritability, and even

inflammation of the throat and tonsils, is exceedingly common. Graver evils, such as paralysis. mental decline, and loss of sight from wasting away of the optic nerve, have been charged to excessive use of tobacco; but when we see the enormous number of persons who indulge heavily in the weed, and the comparatively rare occurrence of the affections in question, where there is not some other obvious and valid sense for the same, the claim that tobacco is to blame for the disease must be received with caution."

Cigarette smoking has become very common with young men within a few years, and this indulgence is regarded by many as less harmful than the use of cigars or a pipe. An eminent London physician expresses the following: "Scarcely less injurious, in a subtle and generally unrecognized way, than the habit of taking 'nips' of alcohol between meals, is the growing practice of smoking cigarettes incessantly. It is against the habit of smoking cigarettes in large quantities, with the belief that these miniature doses of nicotine are innocuous. that we desire to enter a protest. The truth is that perhaps owing to the way the tobacco leaf is shredded, coupled with the fact that it is brought into more direct relation with the mouth and air-passages than when it is smoked in a pipe or cigar, the effects produced on the nervous system by a free consumption of cigarettes are more marked and characteristic than those recognizable after recourse to other methods of smoking. A pulse-tracing made after the subject has smoked say a dozen cigarettes will, as a rule, be flatter and more indicative of depression than one taken after the smoking of cigars. It is no uncommon practice for young men who smoke cigarettes habitually to consume from eight to twelve in an hour, and to keep this up for four or five hours daily. The total quantity of tobacco consumed may not seem large, but beyond question the volume of smoke to which the breath organs of the smoker are exposed, and the characteristics of that smoke as regards the proportion of nicotine introduced into the system, combine to place the organism very fully under the influence of the tobacco. A considerable number of cases have been brought under our notice during the last few months in which youths and young men who have not yet completed the full term of physical development have had their health seriously impaired by the practice of almost incessantly smoking cigarettes. It is well that the facts should be known, as the impression evidently prevails that any number of these little 'whiffs' must needs be perfectly innocuous, whereas they often do infinite harm."

**Boys on the Farm.**—The grave question as to why so many young men from the country leave the farm for other occupations, and how to check the evil, is one of great interest to farmers' households and society generally throughout the country. Comparatively few farmers' boys, especially in New England and the Middle States, at the present time follow the occupation of their fathers, but there is rather a regular stampede of young men from the country to the cities and larger towns, and the places that should be supplied by them as intelligent and enterprising citizens are in a majority of cases filled with the lower type of the foreign element, so that many of our country towns formerly noted for thrift, enterprise, and the intelligence and refinement of their population, have become sadly deteriorated within the last ten or twenty years, while the city is overcrowded, and numerons applicants can be found for every vacancy that occurs, even when the salary is scarcely sufficient to defray the expenses of the board, lodging, and clothing of the applicant. This is a condition of things which does not augur well for the future welfare of our country, and ought not to exist. Farming *can* and *should* be made *profitable;* it *can* and *should*, as an occupation, be made *attractive*, and because it has not generally been made such is the principal cause for the evil in question. Another reason is because the farmers' boys do not fully understand the relation existing between the city and country; they hear of large salaries being paid the city clerk, and do not realize the great difference between the living expenses of the two localities, and that a man in the city is much more closely occupied and confined with his business than the farmer could possibly be. They are also led to believe that farming is not as honorable an occupation as some others. The reason for much of this false prejudice against farm life is that farming has not been conducted in the proper manner and its highest possibilities attained. If farmers wish their sons to regard farming as honorable, profitable, and attractive they shonld *make it such*, and by so doing there would need be no other inducement to require their children to respect and follow it. Professor H. E. Alvord very justly says in this connection: "The fathers and mothers who are at the heads of the farm homes of America must bear in mind that they are laying the foundations, in body and in character, not only of their successors in their own calling, but of the future leaders in almost all the walks of life. The great responsibility thus resting upon them cannot be too forcibly expressed or too keenly appreciated.

Parents make heroic efforts and show much self-sacrifice in educating sons and daughters *off* the farm, but it is a rare thing to see the same exertions put forth to specially educate their children *for* the farm, so that they may enjoy agricultural life, be successful in it, and profit by it. One reason why farming has been held in such low estimation is the idea which has so largely prevailed that any one can be a farmer. Many seem to think that from instinct alone, and without education or the aid of science, one can perform all that is necessary in that employment, and that success depends mainly on the amount of physical labor expended. Hence it has been too much the practice that when a person of ingenuity or fond of research—a youth of promise and eager for distinction—has appeared in the ranks of farmers his attention has been immediately turned away from agriculture to some other field.

The boy with an inclination for study and a taste for knowledge, instead of being provided with an education to render him peculiarly useful on the farm, not only by applying science to its operations, but also by enlightening his father and brothers in this and other branches of useful learning, is at once exiled from the homestead and put in training for one of what are called the 'learned' professions,—and despite the fact that all of these are overcrowded. Or if not a born student, but yet of superior address and enterprise, the boy goes to a commercial college and to the city to be trained as a merchant. Another that evinces unusual genius in the construction of things is fitted to be an artisan. And so it is that the boys kept at home for a supposed lack of talents are doomed to work upon the farm with comparatively few educational advantages.

Such a policy operates to deprive the farming community of its best talents, and in doing this to prevent elevation of character and success in the development of rural resources. The favored boys learn to despise the occupation of their fathers, and feel that it is an employment unworthy of them. Those destined to it feel correspondingly degraded and are apt to conclude that nothing but brute force is needed in the performance of their duties.

How can agriculture be expected to win its rightful place while such practices prevail to any extent ? and this picture is not overdrawn."

Some boys who have left the farm have done so because their natural tastes strongly directed them to choose a certain special employment, and under any conditions at home would have preferred to have chosen a different pursuit than farming. This is as it should be, for if all were farmers we should have no physicians, lawyers, ministers, dentists, merchants, mechanics, etc.; besides, when a person has a special and strongly marked talent in any particular direction he will almost invariably be more successful in following out his inclinations in that respect than if induced to choose a profession for which he has no inclination.

But with the majority of persons the inclination towards different pursuits is largely modified by circumstances and surrounding conditions, or is susceptible of guidance and direction under suitable influences; and the farmer who desires his boys to become farmers generally has it within his power to have his wishes gratified in this respect, if he uses this power judiciously and wisely. Many boys leave the farm because they are allowed so few privileges. We know of farmers who make life to their sons a routine of drudgery from morning till night, with scarcely any pleasures, recreation, or time at home, except to sleep and eat. The everyday clothing is shabby, and the best provided for especial occasions is of cheap quality, coarse, and perhaps quite ill-fitting, bearing a very unfavorable comparison with that of well-dressed boys, and which no child of ordinary intelligence could fail to notice. The table fare is of the coarsest and plainest food, with little variety, and the home for the household devoid of ornamentations and attractions. Scarcely ever is a holiday allowed for fishing or other recreation, or a little spending money ever granted.

We know of an old farmer whose management was precisely of this description, and when any of his boys chanced to earn a little money for themselves from a neighbor or stranger they were obliged to give it directly to him, which he took and put in his well-worn leather wallet with apparent satisfaction depicted upon his countenance, evidently considering that he was bringing up his sons in the best possible way to be frugal, economical, and honest citizens. To be sure, the child might be told that such money was to be laid by to help purchase him a coat, shoes, or other article of wearing apparel; but yet how much better to let the child feel that it was his own property, and permit him to keep it as his own, and to let him spend a small sum occasionally in purchases of his own — not to allow extravagant expenditures, but to teach him self-reliance, how to do business, and to let him feel that he had some rights of his own, some personal possessions — a feeling that would naturally stimulate him to plans of action and effort for the future — an ambition to do something in the world, and be somebody. The sons of the farmer above alluded to (every one of them) left him as soon as they

were old enough to leave home for other employment, leaving him alone in his old age, greatly to his sorrow; two out of the four, relaxing from the old severe regime of home life, became dissipated spendthrifts, while the daughters left home for employment in the city as clerks or teachers, leaving the old couple desolate indeed. This is no overdrawn picture, but is only one instance in many that can be found in real life, and is but the natural result of such unwise discipline. If farmers desire their boys to like farm life, they should try to make it attractive to them; the labor should be made interesting in order to be attractive; boys should be consulted about the farm management; should be given positions of responsibility and trust; should be allowed the ownership of certain farm animals, and be permitted to have the proceeds of their profit for their own. They should also be given the use of a small portion of land, and be encouraged to try experiments upon it, having the sole charge of it. Encourage them to set out a few strawberries, raspberries, grapes, fruit trees, etc., allowing them sufficient time to take care of them.

Commencing in this way, they will go on interesting themselves more and more in the business, if suitably encouraged, and will learn to like it. Farmers' boys should be well educated, and furnished with interesting and instructive reading on agricultural and other subjects. Labor-saving implements should be employed to the best purpose on the farm, in order to render the employment more profitable and less of a drudgery. Teach them to regard farming as just as honorable an occupation as any other employment by honoring it yourself. Make the home pleasant and attractive, and let them see that life is not all a drudgery — a place for coining money simply to hoard it up, and to make stern sacrifices of the necessary comforts of life. Let them be dressed neatly and suitably; treat them liberally, and in such a manner that they will feel that their social and intellectual advantages and privileges generally are fully equal to those of the sons of lawyers, merchants, or any of the other avocations or professions. Study to make farming a success, and thus let them realize that it may be made just as profitable as any other business, when the amount of capital involved is considered, and that it will admit of the same social and intellectual advantages; that there are possibilities in farming which the highest success yet attained has never reached. America's greatest philosopher has said: "The world is all gates and opportunities, strings of tension waiting to be struck; the earth, sensitive as iodine to light; the most plastic and impressionable medium, alive to every touch, and whether searched by the plow of Adam, the sword of Cæsar, the boat of Columbus, the telescope of Galileo, or the surveyor's chain of Picard, or the submarine telegraph, to every one of these experiments it makes a gracious response." It is the man that makes the business, and not the business the man. If farming has hitherto proved unremunerative, make it remunerative by adopting wiser and better methods.

Farmers' daughters should be taught to respect the avocation of their fathers, and not feel above performing the duties pertaining to the farm house — a foolish idea that is too frequently entertained in the farmers' homes of the present day. By treating children in this manner, they will acquire an interest in, and love for farm life, and be more liable to follow it, and succeed in it when they attempt. We are essentially a nation of farmers, and no country in the world has agricultural facilities that can at all be compared with it. Agassiz once said: "In Europe everything is done to maintain the rights and honor of the few; in America everything is done to make a man of him who has any elements of manhood in him." We would say to the farmer: teach and train your sons and daughters in such a manner as to develop to the highest extent the elements of true manhood and womanhood in them; elevate and honor your calling. By so doing, taking advantage of the best experience of others, you will not fail to render it a success for yourself, or to make it honored and loved by your children.

Prof. Brewer of Yale College, strikes the key note of American life when he states that fifteen of the twenty-one Presidents of our country were either farmers or sons of farmers. There is no calling that has greater opportunities than agriculture for the attainment of health, happiness, usefulness, and honor. It is the golden gate through whose open portal young men of ability, education, and integrity may hope to reach the highest possibilities of life.

## PART IX.

# HOUSEHOLD DEPARTMENT.

## THE HOME AND THE HOUSEHOLD.

THE influence of surroundings is so potent in moulding the character, that we have to see but a very little of an individual — frequently but a glance — to determine the atmosphere and general surroundings of his home life. Emerson well says: "A great part of our education is sympathetic and social. Boys and girls who have been brought up with well-informed and superior people show, in their manners, an estimable grace." The face and the manners will reflect upon the outer world the source of the influences that must hold sway, as readily and faithfully as a mirror will reflect the image of beauty or deformity that is placed before it, or the calm surface of the lake will show the character of the heavens that are over it, whether bright and sunny, or frowning with the gathering storm. Pleasant and genial surroundings have a potent influence upon all, and especially the young. The child reared in a home where he is constantly brought in contact with rude, coarse-mannered people, and hears harsh words and unkind criticisms, will be rude, coarse-mannered, and unkind himself, when his nature might have been such that, under proper influences, he would have been the refined, genial, kindly-mannered, and noble man, an honor and ornament to society, instead of the coarse, brutal, and clownish boor that his home surroundings fashioned him into. The home should also be beautified, and made as attractive as possible. This can be accomplished without great expense, for the most expensive things are not always the most tasty and attractive. Bare walls and meager surroundings do not have a tendency to develop refinement and taste in a child. Study to make the home not only genial with pleasant books and kind and loving words and deeds, but attractive to the eye, such as shall cultivate a taste for the beautiful in art and nature, for this will have a refining and elevating influence. However humble the home may be, it should be pleasant, genial, tasty, clean, and comfortable. Never permit your child to feel ashamed to say to a friend or stranger: "That is my home." Good books and papers should be furnished for the home reading. Music in the house is also a source of much pleasure, and has a refining tendency, and binds its inmates in closer harmony. Many a boy with a taste for music would be kept from being away from home evenings, and perhaps thus saved from evil associations, if he could have his taste for music encouraged and gratified. Good musical instruments can now be obtained at such prices as to be within the means of almost every farmer, and money thus spent will often prove an investment of inestimable value to the children in its direct and indirect influences. Besides the good influences of music in the home, and the pleasure derived from it, it also furnishes an excellent means for entertaining company in an easy and pleasant way. Pictures upon the wall, and other ornamentations, a trellis of vines by the doorway, flowers, shrubs, and trees, and everything that has a tendency to adorn the home, are all silent yet potent in their power for good, and lead in the right direction.

**Hygiene of the Home.** — One of the most prominent causes of disease is the carelessness and neglect so commonly seen respecting the sanitary conditions of the home. Neither is this neglect to be attributed to the city alone; people — especially country people — are apt to regard the country as the most healthful and free from disease of any place on the face of the globe, and the city as the hotbed of disease and filth, without stopping to consider that it is the *conditions* and *not* the *locality* that renders a place healthful or unhealthful. The causes of diseases in country homes have been most ably set forth by Dr. W. R. Bartlett, of New Haven, Conn., in the following, which we insert with the hope that farmers and their households may heed the instructions herein contained, and be greatly benefited thereby: "The causes of diseases in country homes may be divided into two great classes: those due to habitations and their surroundings, those due to method of life. By country

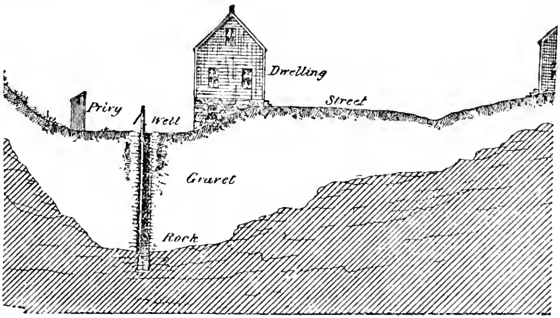
homes are meant those outside of, and removed from large towns, in places remote from the influences of overcrowding and the atmospheric contaminations due to such causes, as well as the *débris* produced by large bodies of people. There are two classes of these homes: first, those which stand alone and separate from other abodes; second, those which are more or less connected with others in towns of small size. There are no more suggestive thoughts than such as are connected with these abodes, and particularly those of the first class. They are the peculiar waymarks of history; these old houses are to our social life what the broken temples of Italy are to art, what the geologic rocks and strata are to the history of the earth. One can read in them the successive eras and periods of that 'struggle for life' through which the inhabitants of the various sections of our country have gone. The early progress of our social evolution can be traced as plainly as any geologic record — at the outside in the scattered heaps of stones or mounds of earth, and a little later in the huge remnants of old chimney stacks, and still later in the broken frame-work, or again, further on, in the lonely, untenanted old house, tottering and ready to fall; or each period is illustrated in some single old manor house, still inhabited, which has stood strong against the ravages of the years. Here dwelt our fathers in their stern simplicity, and here abide their children now, in the abodes of a more advanced and complicated method of life, and their history, as related to health, may be stated concisely as follows: The early homes were primitive; consequently they suffered from the absence of necessary sanitary conditions. The homes of to-day, on the other hand, suffer in a twofold way — on the one side from the same absence of sanitary requisites, and on the other from the improper adaptation to the comforts of a modern civilization. I propose to take up and consider the natural and artificial causes of disease in the country in the following order: those that arise in air and water, those that are due to food and clothing, to habitations and to occupation.

**Air.**—The atmosphere, the world over, has essentially the same constituents, but it varies in different localities in meteorological conditions; local causes also introduce certain extraneous matters. It is these two conditions which exercise an influence upon public health. In many localities the variation in the meteorological conditions of the atmosphere are comparatively large and rapid. These atmospheric elements exert an influence varying according to situation and exposure, or proximity to the Gulf Stream and sea-coast. For instance, what along the coast in winter is a fall of rain, a few miles back turns to a fall of snow, which remains more or less constant. A wind which, upon a high and exposed situation, pursues a direct and steady sweeping current, when it reaches a locality circumscribed by hills, whirls and eddies around in irregular waves and with broken force. On the sea-coast the atmosphere may be loaded with moisture, while inland it is dry. Any one who has happened to ride in the country just at dusk, cannot have failed to note the diverse qualities of the air through which he passes. If, for instance, he descends abruptly from moderately high ground, and travels along the lower meadow lands, through which, it may be, runs a small stream—conditions constantly met with in many parts of the country—he will at once observe a peculiar chill in the air and a heaviness which penetrates to the skin, so sudden is the change. These conditions must of course exercise an influence upon the health of those who are subjected to them. They may be compared with certain kinds of clothing which vary in texture and thickness, and so in the sensations which they produce. These strata of the air envelop the body, and cause a sense of warmth or a chill, an enlivening or depressing influence, according as they are wet or dry, or warm or moist. Of those diseases which are due in part to the natural conditions of the atmosphere, consumption is to be particularly named; this is caused by the sudden and large variations which have been named, and without doubt it would be found, upon investigation, that the low grounds which have been alluded to predispose to the disease. It also occurs to a greater extent upon the sea-coast, and in localities situated between adjoining hills.

So, too, catarrhal and bronchial diseases and rheumatism, and also malarial and typhoid diseases, are produced by these circumscribed localities. Pneumonia is another disease especially to be noted as due to atmospheric causes, and it sometimes sweeps as an epidemic over a large area of country. Mr. Haiviland, a recent English writer, states that valleys shut in with stagnant air and retentive soil productive of humidity, predispose to rheumatism and its frequent concomitant, heart disease, and the more so when the population are ill-clad and exposed to the weather. Then there are other elements which pervade the air as poisons and sweep over it with varying degrees of virulence, and are made manifest in epidemics of diphtheria, influenzas, and eruptive diseases, and in that hitherto insidious and unexplainable influence named malaria, which has been for the last few years gradually

working its way over sections of the country where it never appeared before. The above atmospheric causes of disease are for the most part natural and unavoidable, and must be guarded against by proper attention to èxposure and protection of the body by proper clothing. We now come to removable causes of disease, which are introduced into the atmosphere by local causes and the habits of mankind. It is to this class that hygiene especially directs its efforts, but as they come more directly under the head of habitations they will be considered there.

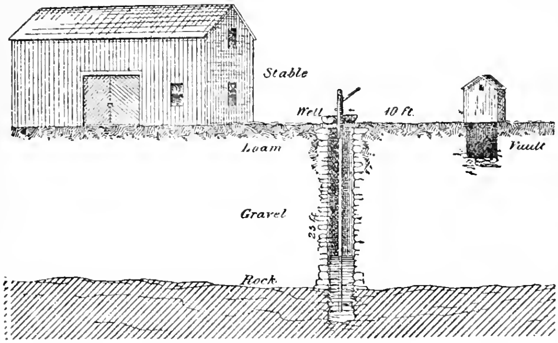
**Water.**—Closely allied to the air is another natural condition and necessity, which exercises a more potent influence upon the condition of health, viz.: water. This, again, is a constant combination, but, like the air, admits into its combination even a greater amount of foreign and deleterious matter, as well as that which is remedial in its effects. Most waters are comparatively free from mineral matters; but there are here and there springs containing iron, magnesium, and sulphur, and the various salts of potash and soda, which have a local or more wide-spread medicinal celebrity; and although any sample of water would probably disclose a minute amount of mineral matter upon analysis, yet as a rule it does not exist in sufficient quantity to produce injury to health. Almost all waters contain the chlorides, or lime in minute quantities. It is the organic and excrementitious substances which enter into it in solution that produce the mischief. These arise from two causes: decaying vegetable matters from vegetation which has flourished in lakes and streams, and the contaminations of water by local and artificial conditions, such as drains, privies, farm-yards, cess-pools, manufactories, etc. Nowhere is there more neglect shown upon this important point than in the country. Go from farm-house to farm-house, and I venture to assert that in ninety per cent. the sanitarian will find some neglect in this matter of water-supply, either small or great. A man, for instance, digs a well in close proximity to his house; at the same time he locates his drain for the sink and places the outlet within a few feet of the well, so that a mere layer of soil separates the one from the other; the consequence is, that while the insoluble matters may be filtered out, the far more dangerous soluble, impalpable matters are transmitted to the drinking water, to produce, if no worse, a slow and chronic poisonous influence upon those who partake of it. Instances have been mentioned, strange to say, in which a strange communication has been found to exist between the well and sink drain, and that, too, with the knowledge of the parties in interest. Another method of pollution by slops is the practice of throwing them upon the ground near the well, when in course of time they are absorbed into its contents. Again, the water may be taken from a spring at a distance from the dwelling, and the owner congratulates himself upon his superior supply of pure spring water; but if an examination were to be made of the source of supply, the chances are that it would be found to be in a neglected condition, partially filled with decaying wood or leaves, and its bottom covered with finely pulverized decomposed vegetable matter. Or he may take his water from a cistern fed from the roof, a practice which should be avoided if possible. If this is not properly ventilated it becomes foul from neglect, the water acquires a foul odor, and its use is injurious to the health.



HOW WELLS ARE POLLUTED.

Again, the farm-yard is often located within a few rods of the well; the consequence is, that a similar contamination takes place as in the case of the drain, and after a rain, when the soil becomes saturated with these matters, they are taken up by the underground water-passages and transmitted to the well; often the water is discolored, and has the taste and

smell of the barn-yard. The same pollution may occur by reason of the improper location of the privy, though I believe that it does not occur as often as in the case of the others, for sanitary work usually begins here, and even the mind uninstructed in sanitary matters recognizes in a measure the dangerous character of human excrements, while it fails to see the danger which lies in the emanations from barn-yards and decaying vegetable matters, from a belief that Nature is competent of herself to dispose of them. It is not necessary to mention in detail the diseases which arise from impure drinking water. Typhoid fever is one of the most important, and every country physician can call to mind cases in which he has traced the disease to one of these sources of water-pollution. But there are certain obscure cases of disease from this cause which are often overlooked — cases of marasmus, so to speak, in which there is no well-defined malady, but a train of irregular symptoms, one or more in a family being affected; there is a general feeling of *malaise*, loss of appetite and weight, alternations of diarrhœa with periods of regularity, and so on. These symptoms cannot be accounted for on any ordinary principles of disease, but many times they are due to a chronic poisoning from impure drinking water. Ask one of the family if the water is good and the reply will be, "Oh, yes, doctor, we have the best well in the neighborhood," and they will show a specimen. It may be perfectly clear and tasteless, and apparently pure: but an examination of the sink drain—one of the other methods of well pollution—will disclose them in close contiguity, and evidently discharging a subtle poison into the water. The important fact that apparent purity is not a safe guide in estimating the purity of water is not generally known. But it is true that analysis even often fails to detect the element which produces disease, when it has been established beyond a doubt that it does exist in the water; the only safe criterion, then, is absolute removal of the cause.




POLLUTION OF WELLS.

**Food.** — "Give me an old-fashioned country dinner," sighs a well-fed man of the world, tired of and satiated with the delights of artificial cookery; and indeed there is nothing better calculated to appease the appetite and nourish the system than such a repast properly prepared and cooked; but unfortunately our cookery is not of this high character, and I am compelled to go even farther, and say that country cookery, as a whole, is behind the age, and in its preparation advantage is not taken of the knowledge which science so readily affords. All the requisites for good food are met with in the products of our country homes, but how sadly are they misused. Take, for instance, the cooking of fresh meat. In the great majority of cases it is put into the frying-pan with a little fat, and then subjected to a scorching or frying process at an intense degree of heat, which soon deprives it of its juicy elements, and it goes upon the table dry and hardened and difficult of mastication; and at last, when it does enter the stomach, and the process of digestion is accomplished after much labor and exhaustion of nerve force, it affords but a tithe of the nutriment which it originally possessed, and which proper cooking would have developed and saved. Take, again, the article denominated pie. I shall not attempt to detail the process by which flour and fat are mingled together and subjected to the baking to bring forth that indigestible compound known as pie-crust; but it is safe to say that it is responsible for a large share of the adult dyspeptics and pale, sickly children we are constantly meeting with in this country, the chief delight of this latter class being to invade the pantry and feed upon a huge slice of this compound, until the stomach is gorged to repletion, and digestion weakened and exhausted. There are few housewives who know

how to make good bread. It can be made, all the elements are at hand, but, either through ignorance or carelessness, a large proportion of it is heavy and indigestible, and what is really one of the most important and nourishing articles of food greatly impaired in its usefulness, and even made the vehicle of harm to the system.

So I might go on and mention other articles and methods of badly cooked food—as, for instance, the boiling of potatoes, which, improperly done, brings to the table hard, water-sogged masses, instead of a delicate, feathery, nutritious article of diet. The whole matter may be summed up as follows: too much haste in compounding and cooking is allowed—this partly from multiplicity of duties and partly from carelessness. But, above all, there is a lamentable want of knowledge on the part of the wife and mother, of those principles which should guide her in the preparation of the daily food of the family. It is not chimerical to say, that the housewife should know the general divisions into which food is classed, and what elements each class tends to build up. She should know theoretically what many have found practically, that half-boiled potatoes cannot readily undergo solution in the gastric juice, and that pie crust reeking with fat cannot be absorbed into a healthy system without poisoning the blood, and that it produces a nauseous emulsion in the stomach, which can never be assimilated into healthy fat and tissue. Did she know these simple truths, she would take a maternal interest in preparing such articles of diet for her children as they needed, and would point to her rosy-cheeked, well-developed offspring, as the results of her labor.

**Clothing.** — Passing to the consideration of clothing, there are one or two points where our country residents display a degree of carelessness which cannot be otherwise than injurious, although, as a rule, they are sufficiently well clothed. One point is the neglect to wear proper clothing next to the skin, and especially in summer. It is a common practice among farmers to dispense entirely with the wrapper or undershirt during the summer, and wear only an ordinary cotton shirt next to the skin. Such a practice is dangerous, for when work is stopped, then there is a sudden cooling of the skin and lowering of the temperature, and a consequent liability to the induction of disease Rheumatism, stiff-joints, and kidney-disease are all produced by this sudden suppression of perspiration and lowered temperature of the body. Now, a flannel undershirt of proper thickness, or simply a flannel shirt, worn during the summer, would lessen the danger by graduating the condition of heat. Again, mothers are apt to forget the delicate structure of their infants, and neglect to give proper attention to their clothing. In summer the dress is too light; thus they are exposed to those atmospheric influences which produce cholera infantum and kindred ailments; while in winter, from the same cause, they are made liable to pneumonia and bronchial diseases.

**Habitations.**—This is an important point, and one in which there is room for and need of much improvement. What then, are the considerations which influence a man for the most part when he builds a house in the country? If he be a new-comer he reasons substantially in this way: I must choose a pleasant, healthful location; it must be convenient of access, and near my farm or place of business; or, if it be a pleasure house, near the means of communication with other places. If he is an old resident about to construct a new house, he very likely demolishes the old house and builds upon exactly the same spot; or, if he selects a new location, he reasons generally like the former. In other words, both are guided in their selection for the most part by the considerations of eligibility, economy, or beauty of construction, and least by the apparent minor conditions which are to afford the household health. He neglects in the internal arrangement of the house to provide the best means for warming and ventilation, and the proper discharge of the sewage. And in the arrangement of his outbuildings he will very likely counteract in the most systematic manner the benefits of his naturally good surroundings. He will locate his barn within a few rods of the house, in order that it may be convenient, and lay out his barn-yard upon the side facing the house; or he will dig his well in close proximity to his house, and at the same time make the outlet of his sink drain discharge within a few feet of it, or his privy will be located within a few feet of the doorway; it will have simply a vault as a receptacle, which is not often cleaned or disinfected. Again, his cellar may be dug in springy ground, from which water and dampness are constantly exuding, to rise and chill the rooms above. This matter of damp cellars is one of great importance, from the frequency of their occurrence. It is not uncommon even to find cellars in which water is constantly standing, often mixed with decaying vegetable matters and the filth which has gradually accumulated there through neglect and carelessness. The writer has in mind such a home, in which one of the family was taken down with typhoid fever and died. A short time after another was also attacked

with the disease. That was a time when physicians were not as alert to discover sanitary defects in the household as they now are, so it went on until the third member of the family was attacked; then diligent search was made for the cause, when it was found that the cellar bottom was constantly covered with water, mingled with decaying vegetable substances.

This is no isolated case, but can be verified by the testimony of many. In such a way, an otherwise fair home is surrounded by a cordon of disease-producers, while the owner flatters himself upon his desirable and healthy location. The question now recurs, How should a man reason in the construction of a home in the country? Something like this: I am about to construct a house, which is to be the home of my family, consequently I must consider, first and above all, how best to adapt it to the health and comfort of its occupants. I must realize that the causes of disease to which we shall be subjected are many of them to be of our own making; and if I construct my home so as to avoid them at the outset, I shall be teaching them a lesson, and inaugurate a course of action which they will naturally learn to follow. The man who reasons thus will reason simply and intelligently, and his home will be a model worthy of imitation. It is no difficult matter to construct a home in this manner. No one rule can be laid down for all cases; but if the importance of building upon sanitary principles is once realized, there is no place where it can be more easily and better done than in the country. If the soil is damp, it should be well drained. In the matter of damp cellars, they should be well cemented, or sub-cellars only should be constructed, three or four feet deep, thoroughly cemented and ventilated. All out-buildings should be located at a safe distance from the house. The house should be warmed throughout, if possible, and all rooms should be thoroughly ventilated. Slop water should be disposed of in such a way that it cannot contaminate the air near dwelling houses. The best way is to deposit it upon the surface of the ground, not near the dwelling, by means of suitable discharge pipes. All tanks, cess-pools, reservoirs, etc., for storing liquid or solid refuse, should be looked upon as likely to cause serious trouble. If they are used, they should be made tight and frequently emptied. Water-closets should be used if possible; if not, there should be a frequent disinfection with dry earth, and prompt and complete removal of all excrement.

The line of thought has thus far been directed to the homes of the well-to-do and industrious part of the community. But there is another class in the country—namely, the poorer and impoverished class—to whom a special consideration is due. In every town and hamlet they are to be found, and usually congregated together in one locality. Of all poor people, they are the poorest. Seemingly without energy or decision of character, they go on through life surrounded by the means of comfort and a livelihood, but yet are content with a bare existence. Most of them have intermarried into the same class, and have thus produced a numerous offspring, possessing the same qualities of mind and character; and so the succession is kept up from generation to generation, and the passer-by of twenty years ago, should he revisit the same locality, would see the identical worn and dilapidated houses that met his gaze before. These people are many of them well-meaning, some of them industrious, but it is no misrepresentation to say that among them are found the open vices of our country homes, for the most part. It is common among these families to find one or more of them the victims of their own or their parents' vicious habits. It may be phthisis, or epilepsy, or idiocy which they are afflicted with, but the cause may usually be traced to their immoral habits, or to intemperance and irregularity of life. Much is due to intemperance, for this is their special vice; they are the village rumsellers' main support—for among the better class this vice is comparatively little practiced. Almost all the male members of this community are habitual drinkers, and many of the female portion also; and when they reach middle life are more or less broken down by the effects of this habit, while the children follow in the same course at a slower pace. The amelioration of this class is a problem for the philanthropist, as well as the physician, and it is a difficult one, too; but a united action on the part of the profession, backed by the better part of the community, can do much toward their elevation, and particularly in the matter of intemperance. The closure of the low groggeries from which they obtain their poison would be a beginning in the right direction, which would lead to a higher moral standard, and thus toward permanent results. Systematic effort applied to the elevation of this class of people, which familiarity has made contemptible, would materially lessen the number of those supported at public expense in jails, hospitals, and reformatory institutions generally.

**Occupation.**—Most of the inhabitants of our country homes are engaged in the occupation of farming, though, of course, manufacturing is carried on to some extent; but most of these are located in the larger towns, and do not come within the scope of this paper. The causes of disease, then, which fall to our consideration as due to occupation are those

pertaining to farm life, as relates to the male portion of the community, and to domestic or indoor life, as relates to the female sex. The question, then, at once arises, Is farming healthful? It would seem to be the height of folly to attempt to disprove, or even criticise, this almost universally accepted belief. Let it be granted that the principle is true, yet there remain certain aspects of it through which the lover of honest criticism can easily penetrate. Farm life possesses three beneficial elements: constant physical development, abundance of pure air, absence of excess and simplicity of life. Against this must be set three elements of danger: constant physical and mental strain, irregularity of life, exposure to the inclemency of the weather. That it is possible for the farmer to so conduct his affairs as in a great measure to reap these benefits, and not expose himself to the dangers, cannot be denied; but practically he does not often do so. A sketch of a farmer's life will make this apparent. A young farmer sets out in life, ambitious of a competency. He rises early, and goes at once to his toil. After a hasty breakfast, the regular labor of the day is begun, and continued till noon, when he gives himself a short dinner hour, then resumes his labor and continues it through the day, till, worn and weary, he seeks his home at night. Completely exhausted, too tired for recreation, he is obliged to spend his evening in quiet to recuperate himself for his next day's work. Often he rises in the night-time and takes a long journey to the neighboring market, exposing himself to the chilly night air, and careless as to his clothing; and if he returns before the day is done, takes up some unfinished task and continues his labors again till night, devoting but scant time to rest and food. This course of life is continued day after day, and year by year. In the meantime he is economical, and laying up a competency; but is steadily breaking down his physical health, as his weakening constitution and stiff joints so often testify.

This surely is a picture of excess, and one in which the good elements of farm life are sadly perverted and misused. It is not only a physical wear and tear, but what is more, the mind often sympathizes and becomes broken or enfeebled in its operations. The records of the Connecticut Hospital for the Insane, for instance, show this with startling emphasis. An inspection of them shows, that of the whole number of males admitted from the beginning, of the various occupations 170 are farmers, the total number being 773.

**Farmers' Wives.**—We pass now to speak of farmers' wives. The same records show that, of the whole number of females admitted to the Connecticut Hospital for the Insane from the beginning, which is 558, 215 are housewives, and of course for the most part the wives of farmers. When one considers the method of life of this class of persons, it does not seem so surprising. Take for illustration a young farmer's wife, the companion of him who has served as our previous example. She may not be very strong physically at the outset; but be that as it may, she enters into all the plans of her husband with alacrity, she assumes the entire control of the house and does her own work; this is well enough at the outset; but soon she enters upon the maternal state, and a young and increasing family becomes a part of her care, and draws upon her in a twofold way; she bears not only the physical strain of child-bearing, but also continues to perform her own household duties; her husband's business still increases, adding more yet to her already multiplied duties; but still she presses on, and so continues, till her pale, anxious face and weary step tell of a constitution broken at once mentally and physically. This is no imaginary picture, but one enacted continually among our farming people to-day. The average farmer's wife is one of the most patient and overworked women of the time. One has only to attend one of our village churches on some Sunday in the summer to obtain a critical view of our overtaxed farmers and their wives; a glance over such an assembly reveals a set of faces whose very lineaments are drawn and wrinkled from overwork; they tell of lives of constant, unremitted toil, the signs of which even a Sabbath day's rest cannot at all efface. It may not be necessary to speak of the occupation of the children, yet there are one or two points not to be overlooked. It has passed into a truism, that farm life is the right kind of life for a pale, sickly boy, but true as this may be in a general sense, there are yet many exceptions which should not be overlooked. Take, for instance, the younger child of this pair above described. He is, perhaps, a weak, frail child, and when he reaches the age of six or eight years he begins to labor on the farm, doing such light work as he is supposed to be able to bear. As he grows older his tasks increase; at the same time he is pursuing his course of study at the district school; but gradually he acquires the same habits as his father, and his growing body is subjected to a strain which it is ill able to bear, and he grows up weak in body and mind, an old man at twenty, or it may be dies of phthisis, while engaged in the very occupation which popular opinion calls the most healthful. It would not have been so in his case, had his life been properly guarded, and he would have

developed into a healthy manhood, had his labors been properly adjusted to his strength and his life been conducted upon hygienic principles. Parents, in choosing a course of life for their children, should consider whether the child can bear the strain of farm life, and whether it coincides with his mental organization, and should so shape his course that he shall leave the farm at a proper age for some other occupation if his constitution so demands, and then the sickly young boy often develops in strength and bodily health. The cry so often uttered, "Keep the boys on the farm," is a senseless one, indiscriminately applied, and cruel in its working; for the boy who is not adapted to that occupation should not be subjected to it, any more than the thin-skinned, delicate-limbed horse should be harnessed down to the plow.

The salient causes of disease in our country homes have thus been passed in review, in the hope that the attention of the people will be thus in a measure attracted to matters of such vital interest to them and their children."

**Sleep.** — Sleep is one of the great restorers of wasted vigor and strength, and is one of the most important requisites in maintaining health and vigor of both mind and body. It has been called "Nature's repair shop," where all the repairing of the body and mind are secured. There is nothing that can take its place in this respect. One of the leading symptoms that frequently precede insanity is an unnatural wakefulness, and inability to sleep, showing an intense nervous condition. A disordered state of the nerves can best be cured by a full amount of refreshing sleep. Many a man and woman has grown prematurely old, and perhaps broken down and died at middle age, simply from over work and loss of sleep, when if they had taken more time for sleep they might have lived to an advanced age. Farmers and their families, as a rule, do not spend the amount of time in sleep they ought. Professor Chandler, President of the New York Board of Health, states that one-half the deaths that occur are unnecessary. With a view to lessening the rate of mortality, he urges upon every person to apply the best knowledge obtainable to the care of his own human machine. "No board of health or city government," he says, "can do away with sickness unless each one carefully guards himself." He dwells at length upon the necessity of pure water, wholesome food, sufficient clothing, sunlight, rest, and recreation as all-important if one would possess good health.

Children are constantly being injured mentally and physically from not having sufficient sleep. They are taught that it is laziness to lie in bed beyond a certain hour in the morning, and that there is great virtue in "early rising," or are forced to be up early under all circumstances, and are therefore deprived of the full amount of sleep that their constitution requires for a healthy development. One has but to look into the prematurely old faces of little children that work in the factories or shops to notice this, as well as of many boys and girls that are found in farmers' households. Some persons require more sleep than others; each one must be a law unto himself in this respect. Children require much more than grown people, and young and middle-aged persons more than old; while in each individual case there will be a great difference in this respect. Some of the greatest workers in the world have been the greatest sleepers, and because one person requires more sleep than another, it is no indication of indolence in the latter, or of great industry in the light sleeper. Many incurable nervous diseases are brought on by a lack of sleep, while on the contrary we have known serious and seemingly incurable difficulties of this kind completely cured by having a full amount of it. A good rule in this respect is to allow a person to sleep as long as he will sleep sound. Idling the time by lying in bed in an indolent, half-dozing state is not sleep. If parents wish their children to arise early in the morning they should see that they retire early at night in order to have the full amount of rest that their systems require.

**Recreation, Visiting, etc.** — Farmers and their families are generally so busily occupied, that they feel unable to take much time for recreation, visiting, entertaining company, etc. While labor is a duty as well as a necessity, and the practice of industry a virtue, and the road that leads to health, happiness, and wealth; and while idleness is a vice with its long train of attendant evil consequences, yet there is danger in the majority of cases among farmers of perverting the good that may result from industrious habits into evil, and making life a mere drudgery, with comparatively no recreation, and the almost entirely ignoring of the social relations of life. It should be remembered that every one requires periods of recreation and rest; the health demands it, besides such periods are bright spots in life that lighten and cheer the days of toil. It is positively injurious to the health of the mind and body to be constantly occupied in one little round of duties, with no change, no variety to give relaxation. If the farmers of our country and their families would work less hard, take

more advantage of the improvements and facilities for labor saving, and adopt methods of improved agriculture more generally, and spend more time in rest, recreation, and the cultivation of the social qualities than the majority of them do at present, farming would not only be more profitable and less laborious as an occupation, but there would also be more of health and happiness connected with it.

More holidays should be observed by the farmer than there now are. Each household should have holidays and anniversaries of its own to be observed, such as birthdays and marriage anniversaries. Let each child feel, by some pleasant notice being taken of its birthday as it comes around, that it is an event to be honored, and looked upon with pleasure, and that they are of some importance in the world, and it will tend to brighten life, and endear home and its memories to the heart in after life.

**Winter Evenings.**—The long winter evenings afford the opportunity for pleasant social enjoyment in the household, such as conversation on special topics, the establishing of a home lyceum, reading aloud, singing, instrumental music, pleasant, quiet games, or those that are of a more social nature, such as charades, character personations, etc. These should be sanctioned and sometimes participated in by the parents. Children require some amusement; they cannot move according to fixed rules, like mere machines. They are active, restless, eager for occupation, fun-loving and social in their nature, and they must have relaxation of some kind. If they cannot have amusement at home, they will be very likely to seek it abroad as soon as they have the opportunity. Many a youth has been led to seek amusement in the exciting scenes of the gambling table, liquor saloon, and other places of evil associations, because his home was lifeless and dull, and its associations had nothing to amuse, instruct, interest, or attract. Under such influences he soon becomes reckless and dissipated, and goes down to ruin, only another instance of a blighted life, which in all probability pleasant home associations might have ennobled and saved to future usefulness and honor. The isolation of the country dwelling should suggest to the farmer the special necessity of his favoring and providing home amusements for his children. The memory of a beautiful, happy home, with its hallowed associations and teachings, has saved many a man from yielding to temptation and treading a downward course, and is one of the richest legacies that parents can leave their children.

**Kindness and Politeness in the Household.**—Many persons are very particular respecting their manner when in the presence of strangers, or when away from home; while at home, and to the members of their own household, they are at times very unkind and impolite in speech, as well as in manner. True politeness is kindness expressed in a pleasing manner. While we should ever be polite in our treatment of strangers and those with whom we come in contact, to whom is greater kindness and civility due than those endeared to us by the ties of affection and nature? It is not uncommon to see husbands and wives show such marked incivility towards each other as would be regarded by either as not to be tolerated in the common civilities among refined and cultured people. The same may be said of brothers and sisters. This is what should never be. The home should be the dearest spot on earth to its inmates, who should entertain for each other that affection which the nature of their relations would naturally incline, and, such being the case, scarcely too much care can be taken to avoid the least unkindness of look, word, or deed; neither should the little civilities that would be accorded a stranger, for whom we have no especial interest, be disallowed under similar circumstances to those we most love. This incivility is generally the result of carelessness or thoughtlessness; yet, notwithstanding, it has much to do towards marring the happiness of home life, and in warping the character of both those who practice and receive it. To be sure, home should be the place, of all others, of freedom from restraint, where we lay off the formalities of society; yet we should not abuse the liberty of home life, and blight its pleasure by the practice of such unkindness and incivilities as would not be tolerated outside the home circle. A pleasant "thank you," "excuse me," or "please," in receiving a favor, making an apology or request, costs nothing, and is as justly due the loved ones of our own families as to the outer world, while they do much to soften and refine the character, improve the manners, and brighten everyday life. There should be more affection manifested and more confidential relations established between the different members of the household than is usually seen. Parents should be careful to set the example of politeness for their children by being polite to each other and to them, thus teaching by example, as well as by precept, which is by far the more forcible. Parents have no right to expect their children to take a higher standard in any respect than they themselves have taken and are daily occupying in their presence. They should seek a high moral, religious

and social plane, and teach their children to do the same. Children should remember that they have duties which they owe their parents, obligations that they can never fully repay, and should endeavor in every way possible to make home pleasant for those who have bestowed so much care and affection upon them.

The late Alexander Hyde has well said: "Not every farmer that builds a spacious and convenient house for his family succeeds in making that family comfortable. Together with the building of his house he must build himself on the solid foundation of all manly virtues, and together with the culture of his farm he must cultivate all kindly affections. Nor should these affections be confined to those of his own household, but extend to his neighbors, and to the whole brotherhood of man. The farmer's home should not only be the trysting place for children, grandchildren, and relatives, but the seat of refined and generous hospitality. God has made us social beings, and he only enjoys home in its fullest extent who there ministers not only to the wants of his family, but entertains his friends cordially and liberally. In thus laboring for a comfortable home and cultivating all family and social affections, and ever cherishing gratitude to the Giver of all good, we may confidently expect that our homes will foreshadow the perfect bliss of heaven."

**Practical Suggestions to Housewives.**—SLOVENLY HOUSEKEEPING, ETC. Slovenly housekeeping has been the cause of untold discomfort and unhappiness in life, while a neat, tastily arranged, orderly kept house adds greatly to the comfort, health, and pleasure of the household. Besides the comfort of an orderly house, it is much more easy to keep things in order than to be constantly searching for mislaid articles, and thus keeping the whole house in a turmoil. Many housekeepers take the hardest way of doing everything, are always hurried with work, labor hard from morning till night, yet never reap the benefits of such labor, because they do not plan their work well, and have no system or method in performing it. They have no regular place for anything, and are constantly mislaying things that have to be hunted up. There should be a place for everything, and everything kept in its place. In this way, much time and labor will be saved, and a great deal of discomfort avoided. Perfect cleanliness in every department of the house is essential to the preservation of health. Never permit any decaying matter, such as vegetables, fruit, etc., to remain in any of the rooms, or the cellar, as fevers, diphtheria, and other similar diseases are frequently caused from such carelessness. Allow no disagreeble odors about the premises to escape your notice, and when there are such, search until the cause is found, and then have it remedied. Be neat and orderly about your dress as well as your house. This may be regarded as one of the "little things" by some, yet it is the little things of which life is made up, and by which much of its happiness or unhappiness is regulated. Study economy and avoid extravagance, and in so doing it would be well to consider what true economy consists in, as well as the nature of extravagance. True economy does not consist in always buying things of *poor quality* because they are *cheap*; or extravagance the purchase of a good article that will last several years, and paying a reasonable price for it. As a general rule, articles of the best quality are the cheapest and most satisfactory in the end. Not unfrequently the slight improvements, made at a trifling expense, through the influence of the wife's taste and tact, add more to the value and attractiveness of a home than many times the expenditure invested under the husband's management.

In no position is inefficiency more deplorably felt than in the household, since a slovenly, inefficient housekeeper has it within her power to mar the happiness of so many others—her husband and children—whose home atmosphere and comfort she so largely creates, and she requires much ingenuity, capability, and tact, in order to meet fully the requirements that are within her especial province.

**Inordinate Neatness.**—The opposite extreme of slovenliness, is inordinate neatness; in other words a neatness which is such a severe regime, that it precludes the use and reasonable enjoyment of home, and the things pertaining to it. There is not much comfort in a house where everything in it is regarded as too sacred for use, or a particle of dust regarded as a calamity, while the one who is the cause of the slightest disarrangement of the regular plumb and line system is subject to the severest criticism, either of look, act, or word. We have seen homes where the order evinced was of such a severe nature as to cause a feeling of restraint that was absolutely painful, and one would feel relieved and free when getting out into the open air again. True hospitality rarely prevails in such houses. Company are regarded as intruders; they disarrange the books and furniture, which require care and labor to rearrange. The wife and mother cannot throw off her household cares and sit down to the enjoyment of conversation with the old friends, or enter into the enjoyment of her

children, because of her "much serving." Such should remember that a heart-felt word of welcome, and warm clasp of the hand, are far more to a guest, than the most exquisite carpets or furniture, or spotless table-linen. There are bare cabin homes that will be cherished in the memory with pleasure, because of the beautiful and loving presence there, and stately palaces that will leave upon the mind the chill of an iceberg,—shining and glittering, but cold, and forbidding. Furniture and other home appointments were made for comfort and enjoyment, and not especially for being set apart at right angles in a room, or to be kept for ornament alone. Don't put all of the choice and beautiful things apart for strangers' use alone, let the "best room" be the one in which the family spend the most of their time; such a room should be in the most pleasant and sunny part of the house, while nothing in the house should be regarded as too good for its inmates to enjoy.

**Fretfulness.**—Goethe says, "He is happiest, be he king or peasant, who finds his happiness at home." Archdeacon Hare has well expressed the idea of home as follows:—"To Adam, Paradise was home, to the good among his descendants, home is Paradise." One of the highest privileges of mankind, and the central duty of life, is the creation of a refined and happy home. Such may be justly regarded as the best product of Christian culture. Home should be the most pleasant place in the whole world for every inmate of the household, and the place in which each will most desire to spend evenings. But it too frequently happens that the husband and sons spend most of their evenings outside of the home circle. When such is the case, it would be well for the wife, the mother, and the sisters, to ask themselves whether they are individually, either directly or indirectly, responsible for this. A habit of fretfulness is one of the great faults seen in many homes. A nervous, irritable disposition is indulged in, until the habit of fault-finding and fretfulness becomes confirmed, and is frequently showing itself with the slightest provocation, or with no provocation at all. One such inmate in any home will destroy much of the happiness of all the others. Life has many cares and responsibilities, but we must meet them, and meet them bravely and cheerfully. Don't add to their weight by repining and fretfulness. Be patient, kind, and charitable to all. Many a true heart has been estranged by an impatient look or word, thoughtlessly given, and after wandering, would have come back after the first transgression like the dove to the ark, had it not been frightened beyond recall by the angry taunt,—the cruel charity of an unforgiving spirit. Cultivate patience and cheerfulness, not alone for your own sake, but for the sake of those about you whose comfort and happiness you, as wife and mother, have it so much within your power to control.

Emerson, in referring to heredity law says: "At the corner of the street you read the possibility of each passenger, in the facial angle, in the complexion, in the depth of his eye. His parentage determines it. Men are what their mothers made them." If this is true of heredity law, it is also true of influence, for the mother has it more within her power to mould the plastic mind and character of the child, than any other person in the whole world; and if she so wills it, the home influence may be salutary and ennobling; but if on the contrary she is indifferent and careless in this respect, caring more for the practical gains of life, than the happy and salutary influence of her home, she dwarfs and mars the character that might have been hers to beautify and exalt.

**Good Cooking.**—Not only the comfort but the health of the household depends much upon the manner in which the food is cooked. We believe more dyspeptics are made every year by poor cooking than any other cause, to say nothing of domestic discords that might be traced to this source. The manner in which an article of food is cooked, has far more to do with its healthfulness, or its being palatable, than the quality of the food itself. It is the duty of every housekeeper to acquaint herself with the best methods of cooking. Every girl should learn the practical and most approved mode of doing things pertaining to housekeeping, that whether she is obliged to do the work in her family or not, she will understand how it should be done, and be able to instruct her servants, and also to know how much labor to expect of them. A household whose table furnishings are entirely under the control of servants, with no direction from a more intelligent source, is indeed to be pitied, and a woman who feels above looking after the welfare of her own family in this respect, has a very narrow and false idea of the true dignity of her position as the head of the family, as well as the duties pertaining to it. One of the most common articles of food that is unskillfully made is bread. Good wholesome bread, which is regarded as the staff of life, is more rarely seen than is commonly imagined. Bread, as it is usually found, might quite as appropriately be denominated the "staff" of disease and death as "of life." Good yeast bread is too scarce an article of diet, and vile compounds with cream-tartar and saleratus or soda or baking

powder too commonly used as a substitute, because more quickly and easily made. Bread should be sweet, light, palatable, and wholesome; and when made of the proper materials, and in the proper manner, it will be such; but when made of poor flour, poor yeast, and allowed to over-ferment or sour before baking, or to be but half baked when taken out of the oven, it will not be a suitable article of food. Many housekeepers do not bake their bread and pastry sufficiently; hence, it comes upon the table in a half doughy state, that would seemingly be sufficient to cause dyspepsia to the strongest and most healthy digestive apparatus. When what goes into the stomach has so much influence in determining the health of the individual, no wife or mother should be indifferent or careless with respect to the quality or cooking of the food that is placed upon her table. Hers is the responsibility in this respect, and she should make herself thoroughly efficient either to perform or superintend, as circumstances require, the work that pertains to this most important department of household economy.

**Adulteration of Food.**—The subject of food adulteration is one of momentous importance to every household. The manufacture of spurious articles, and the adulteration of the genuine has become so common, that there is scarcely anything that is safe from this fraudulent practice. This evil has become so universal that it extends to drugs and medicine supplies, as well as food, and is employed in the manufacture of wines, lager, rum, brandies, and other alcoholic liquors to a fearful extent. Physicians assert that many valuable lives are sacrificed from the failure of adulterated medicines to secure the expected result. Nearly all of our groceries and spices are capable of adulteration. Much of the tea, in order to give it color and weight, is poisoned with prussic acid, mineral green, arsenite of copper, verdigris, clay, etc. The coffee that is bought in packages is rarely pure, but consists of various compounds mixed with a small proportion of coffee, such as peas, chickory, stale bread, etc. The writer once entered the grinding and packing department of an extensive wholesale coffee establishment, that had a good reputation for honesty, and there among other adulterants were barrels of mouldy bread that was being roasted in revolving cylinders and ground to mix with the coffee. Even flour is frequently adulterated with poisonous compounds, while the extensive use of glucose in our sugars, syrups, honey, confectioneries, etc., is asserted by medical authorities to be one of the principal causes of the great prevalence of Bright's disease of the kidneys, as well as some other diseases. Sugars and syrups are frequently bleached and clarified with some of the most poisonous substances, such as muriate of tin; and their bulk and weight are raised by ground stone, white clay, and other materials. Spices are adulterated with various substances, or have much of their oil extracted before being put upon the market; ginger with flour and meal; much of the butter found in the market is a compound of grease; while milk is rarely obtained pure from the dealers in this article. Vinegar is not all made from cider, but from different acids, and the glass washings and refuse beer preserved in beer saloons. Yeast powders are sold that contain soluble salts of aluminum, and other vile compounds. Pulverized alum is sold for pure cream-tartar, etc.

A recent authentic writer says on this subject: "The agreeable odor of caramel in the neighborhood of the coffee mills tells its own tale, and to explain the wonderful cheapness of the beautiful jellies now in such common use we should have to go further than our matutinal friend 'Rags-bones,' and pursue through the wonderful transformations worked by modern chemistry the bones from our garbage box, flavored and colored by the waste products from gas works, back again to our tables as currant jelly for our famous canvas backs and red heads, and perhaps meet in our sugar bowls our old shirts transformed into very palatable sugar."

Even the vessels in which our food is cooked, or put upon the market, are made of poisonous alloys; for instance, canned goods put up in tin cans. Tin vessels as generally found, are not made of pure tin, but a mixture of lead and tin. The lead is easily acted upon by the acids of fruits, vegetables, meats, etc., which is one of the most subtle and dangerous of poisons that can be taken into the system. While Great Britain, Germany, Belgium, and other European nations have enacted and enforced effective laws for the suppression of the sale of adulterations, in this country we may be said to be almost without legal protection in this respect, and the United States is made the market for the most part of such adulterants as are excluded from the principal markets of Europe. When our government employs a more efficient means of remedying the evil than is at present practiced, which can only be secured by the rigid system of inspection, and the punishment of every violation, we may hope to see an improvement in this respect, and human health and life be protected from the murderous process of slow poison administered in food and drink.

**House-Cleaning, etc.**—In the general care of the house, as well as in the semi-annual house-cleanings, much unnecessary labor and confusion may be avoided by observing system in performing the work, with regular times for doing it. If it be sweeping—sweep, dust, and arrange one room before removing the furniture from another for the purpose. The same rule would save much confusion in house-cleaning, except in case of whitewashing and painting; the carpets may have to be left up about the house, but whenever it is possible, clean and put in order one room before commencing another. This is much better than enduring universal chaos and disorder in a house for a whole month, as is frequently the case in some families each spring and autumn, at the regular recurring house-cleaning periods. Commence at the uppermost room, thoroughly cleaning one room at a time until the cellar is reached. Remove to another room all the furniture, as far as practicable; take down the pictures and carefully wipe the dust from them with a soft cloth, and convey to a safe place, leaning the faces against the wall for protection. Take down the curtains and lambrequins; hang the latter on a line and dust with a broom brush. Take up the carpet carefully and have it properly dusted. Don't permit it to be beaten with a thick, blunt stick, as this will be sure to break holes in it, and cut the stitches. Supple whips, or slender, fresh-cut switches are best for this purpose. Bits of damp paper, tea-grounds, or damp salt sprinkled over the floor before sweeping up the dust, will prevent its filling the air of the room. Sweep the dust up clean, then remove the remainder with a damp mop; there is no necessity of saturating the floor with water; wring the mop out frequently in clean water and wipe it over carefully.

Wipe the walls from top to bottom with a clean white cloth, making the strokes from the top to the bottom, changing the cloth often to prevent soiling. When the paper is gilded, or very delicate, it may be well to use a soft brush, or a cloth wrapped over a whisk brush or a common broom. Wash the paint in warm water, without soap unless very much soiled. For white paint, one-fourth skim milk with the water will make it look new and fresh. Hard soap is best when it must be used; soap will have a tendency to remove the paint, and whenever used the surface should be quickly rinsed with clear water and wiped dry. Common whiting or a little knife brick will aid in removing soiled spots. A little ammonia in the water is excellent for removing finger marks. Never wash varnished surfaces with soapy water. Powdered borax will make old yellow paint look white and fresh. To clean black walnut, wash off in clear water, rub dry, and then apply a little linseed oil on cotton and rub thoroughly, afterwards rubbing with dry soft cotton. Light woods, such as white ash or oak, require nothing but clear cold water and a soft cloth, afterwards polishing off with old soft flannel.

Windows should be washed with suds and rinsed with clear water if much soiled; if not, clear water will answer the purpose. Then quickly wipe dry with a linen cloth, and polish off with a piece of newspaper. The blinds should also be taken off and washed, or thoroughly dusted, or the first rain will be liable to wash the dirt from them on to the windows. If the carpet contains grease spots, remove them with benzine. In putting down carpets a wadded paper lining is a great saving and will last many years. If moths are troublesome, dust Pyrethrum powder around under the outer edges of the carpet. Carefully dust all the furniture, books, etc., before returning them to their proper places. A soft cloth duster is more serviceable than any other for wood work or books. When papering is to be done, always remove all the old paper before applying the new. A good step ladder is very essential in every house, especially in house-cleaning. In sweeping a room, remove all the chairs; and cover the sofa, table, and other articles of furniture that remain with something to keep off the dust. After the dust has had time to settle, dust carefully, not forgetting the rounds of the chair, and all the little nooks and corners in furniture where it will be sure to find entrance. In sweeping sleeping rooms, first make up the bed as usual, and cover the bed with a soiled sheet until after the dust from sweeping has well settled.

**Glossy Starch.**—Shirt bosoms, collars, and cuffs can be made to look glossy by the following method: Take two ounces of white gum arabic, and pour on it a pint of water, covering it to keep out the dust, and let it stand over night. In the morning strain it carefully from all sediment, put it in a clean bottle, and cork it up for future use. One tablespoonful of this water to a pint of starch, and a piece of white wax about the size of a small chestnut melted in the starch, will give a fine gloss when the polishing iron is thoroughly used.

**Ironing.**—"The secret of nice ironing is a clean, hot flat-iron, clean ironing cloths, and well-folded clothes. In ironing a shirt, begin at the binding of the neck; then fold the back

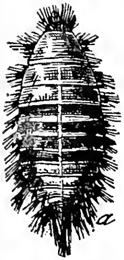
through the middle, and iron it; then iron the sleeves and the front of the shirt; last, iron the bosom on the bosom board; wet the bosom once with a damp cloth, and iron hard and quickly with a polishing iron.

Cuffs and collars are also ironed on the bosom board, as the shirt bosom is. A shirt collar should be ironed lightly first on the wrong side; then turn it over and iron hard on the right, until there is a high polish and it is perfectly dry. In ironing a skirt, slip it over the skirt board; have the clothes basket under the board, so that the skirt may not touch the floor. Iron the right side." Muslin, embroidery, and prints should be ironed on the wrong side; this gives them a much newer and fresher look.

**Washing Window Curtains.**—Plain white window shades should never be run through the wringer, as the wrinkles thus produced cannot be easily removed. Wash clean, and starch rather stiff in starch that contains a little gum-arabic. Hang up dripping wet, and let them dry in this manner. Muslin and lace curtains should, of course, never be put in with the regular washing, as they are easily torn. They can be handled with much less danger if folded before putting them into the water. They should not be rubbed much, but put them to soak a few hours in strong soap suds. Squeeze the water through the meshes carefully with the hands, changing the water frequently. Starch and dry in the sun. Lace curtains should be stretched evenly and pinned to a sheet that is laid on a clean lawn, and fastened in some way at the corners, or the sheets may be pinned to a carpet in a room where they will not be dusted. Blue slightly, and put a little gum-arabic water in the starch, but never iron them. While drying, take pains to see that the edges are pulled out perfectly even and straight, as they will not hang well if they are not even when dry. We have seen nice lace curtains completely ruined the first time they were washed, from the ignorance of the washer, and have also seen them manipulated with such care during the washing process that they came out looking as fresh as when new.

**Washing Prints.**—To wash prints, delaines, and lawns that will fade by using soap, make a starch water similar to that made to starch prints with, and wash in two waters without any soap; rinse twice in clean water. If there is green, dissolve a little alum and put in the starch water.

**The Buffalo Moth.**—This moth has within a few years been very destructive, its destructiveness being particularly manifested upon carpets; hence it has been called the "carpet bug" or "carpet beetle." It works under the edges of carpets, making large holes near their margins. Where there are cracks between the floor boards, it will frequently follow these, and, by working along, cut off whole breadths of the carpet.




*a*, Buffalo Moth.


*d*, Buffalo Beetle (Magnified).

It will also eat woolen articles of clothing when packed away or hanging up, furs, feathers, etc., the same as the common house moth, but are vastly more destructive and more difficult to exterminate. The accompanying cuts show the moth and beetle considerably magnified. The moth is about three-sixteenths of an inch in length, and covered with long, brownish hairs, those at the sides being in tufts. The length of the beetle is about one-eighth of an inch. It is black, and rather prettily marked with bright brick red and white. The best means of killing this insect is to lay a wet, folded sheet along the edges of the carpet, and slowly pass hot irons over it, in order to produce all the steam possible, which, penetrating the carpet and cracks beneath, will kill the moth. Before carpets are put down it would be well to fill the cracks in the floor, and especially between the base board and floor (which is their favorite retreat), with putty or plaster of Paris. Where the cracks are small, hard soap may answer the purpose.

**Selecting Meats.**—Steer or heifer beef, when properly fattened, is the best. It is tender, has a fine grain, a yellowish white fat, and is firm in texture. When first cut, it will be of a dark red color, but after a few moments' exposure to the air it will change to a bright red. It will also have a juicy appearance; the suet will be nearly destitute of fibre, and appear dry and crumbly. Older beef, such as the flesh of the ox or cow, will seem coarser in texture, be darker in color, and less juicy.

The finest quality of mutton will be quite fat, the fat portion being white and hard, while the lean will be juicy and rather dark red in color. When there is but a small quantity of fat that is soft and yellow, and the meat is coarse and flabby, it is a sure indication of poor quality. Both beef and mutton are improved by keeping a while, when the weather will admit. The time will, of course, depend upon the climate, etc. Beef two or three weeks old, and mutton a week or more old, is much better, when it can be well kept, than that recently butchered. Lamb, being more juicy than mutton, will not keep as long. The size of the bones of a lamb will generally determine its age; they will also be reddish in color. Good veal will have flesh of a pinkish tinge, and the fat will be white and firm. Never buy veal that has soft flesh of a bluish tinge. It shows that the calf has been killed too young. The soft, cartilaginous state of the bones also shows this. When the meat looks white, it indicates that the animal was bled before being killed, which is not only a cruel and barbarous practice, but injures the quality of the flesh. Pork should be firm in quality, the fat white and hard, and the lean a pale reddish tinge. Pork that is soft, with yellow fat, is of poor quality.

**Selecting Poultry.** — Few people are as good judges of poultry as they ought to be. All fat fowls offered for sale in the market will not make fine, tender roasts. Every one knows whether poultry is tough or tender when it comes upon the table, and is subjected to the real test it there receives; but it is essential to be able to distinguish between the tender and the tough birds before they arrive at this point. In chickens, the lower end of the breast bone is soft and can be easily bent; in old birds, it is not as flexible. When the spurs on the hen are hard, and the scales on her legs rough, you may be assured that she is old, whether you see her head or not; but the head furnishes the surest indications of age. If the under bill is so stiff and hard that it cannot be easily bent down, and the comb thick and rough, she is old and tough, no matter how fat she may be. A young hen has a soft under bill, a thin, smooth comb, and only the rudiments of spurs; while the scales on the legs are smooth and glossy, and the claws tender and sharp. In selecting turkeys, the lower end of the breast bone should also be soft and easily bent. This denotes a young bird. An old hen turkey has rough scales on the legs, long, strong claws, and callous soles to the feet; while a young one is the reverse of this. An old turkey cock has a long tuft or beard, and a young one a very short one. When these are off, the scales on the legs and size of the wattles of the neck will determine the difference between old and young birds.

It is more difficult to judge of the age of a goose than any other fowl. One of the best tests is the brittleness of the windpipe. If this breaks easily under the pressure of the finger and thumb, the bird is young; if it rolls and does not break, it shows that the bird is old. Other indications of age are rough legs, thickness and strength of bill, tenderness of skin under the wings, and coarseness of the skin. The same tests that are applied to chickens and geese are applicable to ducks, but a young duck's bill is much longer in proportion to the breadth of its head than an old duck's. A young pigeon is known by its pale colors, smooth scales, tender feet, and the long, yellow down interspersed among its feathers. A pigeon that can fly is too old for use, being tough and dry. At this period they have red legs and no down.

**Selecting Fish.** — When fish is fresh, the eyes will be full and bright, the gills of a natural red color, the scales bright, the fins stiff, and the body firm. Never purchase fish that have dim, sunken eyes, dark-colored gills, or that are soft in flesh. No article of animal food will taint or deteriorate in quality so quickly as fish.

**Selecting Groceries, etc.** — The flour at present used is made by two different processes — the old or St. Louis, and the new or Haxall. The latter is designed principally for bread, and the former for pastry, cake, etc. The new process flour packs much more closely than the old; consequently a pound of it will not measure as much as the latter. The rule generally employed in recipes is to use but seven-eighths of the quantity of the new process, or one-eighth less than that of the old. Since the new process flour does not make as good cake and pastry as the old, and is designed more especially for bread, it is well to keep both kinds on hand. The best flour is generally the cheapest. Among sugars, the granulated is the most economical, since a pound of it, being dry, contains more sweet proportionately than that which is damp and more heavy. Avoid sugar with a blue tinge. Black tea is less liable to be adulterated with poisonous substances than green; yet even this is not always pure. By purchasing coffee in the berry, one is more likely to obtain a pure article than when obtaining it ground and ready for use.

**Setting a Table.** — There are various methods of setting a table, which vary according to individual taste in minor details, but the following will be found to contain hints suited to the wants of most households: "The table linen should be spotlessly white and changed frequently to keep it so. A piece of heavy Canton flannel put on smoothly under the tablecloth prevents hot dishes from injuring the table, besides improving the appearance of the linen. The table-cloth must be spread evenly, without wrinkles, the center fold being on the right side exactly in the middle of the long way of the table. Tray cloths under the tea or coffee service and the meat platter prevent the spoiling of the cloth, and are easily removed. Mats when used should be put on exactly straight and with regularity. Napkins should be laid directly in front of each plate. They must be often changed, and great care taken that to each person is given the one that he used before; napkin-rings are of use for this purpose. Fresh napkins should always be given to guests.

Knives and forks, glasses, in fact all small articles, should be carried to or from sideboard or closet on a tray; never in the hand. Great care should be taken in putting each thing on the table exactly even, to give an orderly appearance to the whole. At each place on the right hand, put the knife, with the edge toward the plate; beyond that the spoon for the soup, and in front of both the glass; at the left, the fork with the tines turned up, also a butter plate. Or turn each plate upside down, and cross the knife and fork on it, the knife at the right and the fork at the left, with the napkin between. In front of the gentleman who carves should be put the carving knife and fork; and large spoons near dishes to be served. The coffee or tea service should be arranged in a semi-circle in front of the lady; the coffee or tea pot being on the extreme right with the handles turned toward the lady, and the cups and saucers at the extreme left. Be sure that the sugar bowl is filled before putting it on the table.

A caster, if used, is placed in the center. Salt and pepper casters, unless one for each place is used, should be put at the corners within easy reach. They should always be kept full, and ready for use. Butter balls are made with spadles dipped in cold water; they should be made some time before needed, and kept in the refrigerator. They may be in various shapes, and one placed on each butter plate just before the meal, or passed around in the butter dish. All the plates and dishes used for breakfast and dinner should be warmed excepting those used for salads and dessert. Great care must be used not to crack them by overheating. The extra plates, knives, forks, and spoons needed should be arranged on the side-table. The finger bowls with doilies under them are to be half filled with water, to which a little lemon or other extract may be added. The bread-plate and water-pitcher should be filled and ready on the side-table. Glasses should never be more than three-quarters full. It is better to take them on the tray when filling to avoid spilling the water. The ice should be cracked, and may be put in each glass or in the ice-pitcher. Glasses should be filled just before or just after the family are seated, and again as often as necessary during the meal without any questions.

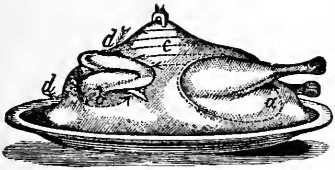
The place of the waitress is generally behind the lady, tray in hand; she should be ready to see, and quick to supply the wants of every one. While the meat is being served, she stands at the left of the gentleman to receive and pass the plates on her tray. Place things on the table at the right, but hand plates and dishes to the left of each person. Soup, clean plates, and finger bowls should always be set down before people at their right hand; other things should be passed to the left, so that they can help themselves. Vegetables, etc., should be passed to each one in succession on side dishes, beginning at the right hand of the host and serving him the last. Covers should be removed with the right hand and quickly reversed to prevent the moisture from dripping.

Remove soiled plates one in each hand. Never pile them up. Before serving dessert, take everything from the table except the fruit dish and glasses; collect with a fork and a plate very large pieces of bread; then with a crumb knife or brush and tray, brush the table, standing at the left of each person in so doing. Always replenish the glasses at this time. Coffee at dinner is served last, in small cups, from the side-table. There are few absolute rules for table-setting and serving. We describe one way, while there may be others equally good.

A person waiting on the table or door should always be scrupulously neat in her person and clothing. She should have long white aprons to wear while waiting at table or going to the door, and colored ones to use while doing her work. She should move quickly but gently, and always going the shortest way around the table. She must never speak unless spoken to, and should avoid listening to the conversation of those she is serving. In case of

accident or mistake, she must not get excited or try to explain, but quietly repair or remove traces of damage."

**How to Carve a Turkey.**—Among the many methods of carving a turkey, the following from a recent writer is perhaps as good as any that could be given in this connection. For a large company, a skillful carver places his fork in the bird, and does not remove it until the whole is divided, and in carving but one side all cutting should be done before taking out the fork. The turkey, having all strings and skewers used in trussing removed, is placed on the table with its head (or neck) at the carver's left hand. A skilled carver will not rise from his seat, but most persons find it more convenient to stand while carving. First

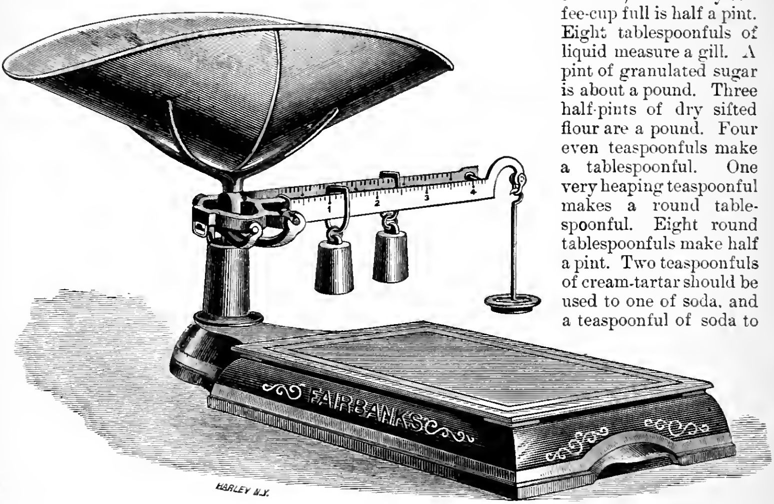


CARVING A TURKEY.

insert the fork firmly, as indicated in the cut; then remove the whole leg and thigh by a cut shown at *a*; next remove the wing by a cut, as at *b*, letting these parts lie on the platter. Then cut downwards as many slices from the breast—the white meat—as there are persons to be served (as shown by the lines at *c*); then make an opening into the cavity of the bird at a place now hidden by the leg, for dipping out the dressing. Next separate the leg (drumstick) from the thigh, or second joint; the platter should be large enough to allow this to be done upon it, but if there is not room, a plate must be used. To hit the joint, notice the movements in an uncooked turkey; the separation is easily made with the right cut. The thigh, or second joint, should yield at least three portions; one with the bone, and two without, and a piece of this, with a slice from the breast served, unless some one is known to prefer a part of the drumstick—as many do—the thigh and drumstick will usually make three portions of dark meat, each; some prefer all white meat, and their liking, if not known, should be asked. Always lay the pieces outer, or skin side up, and add a small spoonful of dressing. Unless the preferences are known, it is proper to ask if dressing will be taken. There is a choice bit just below where the thigh is removed, known to many as the tenderloin, which is easily removed. The side-bone is removed by placing the knife in close to the rump and pressing it towards the head, when a thin plate of bone will come away with some choice pickings upon it. The wish-bone may be removed by cutting down from above, as shown at *d*, *d*. There is a side-bone to which the wing is attached, the removal of which is not difficult, but it cannot well be described. The wing gives one good cut, that nearest the body, and this may be served as white meat. If one side of the turkey is not enough for the company, the other is to be proceeded with in the same manner. The best way to learn to carve is to carefully watch an expert, and note his operations. A close examination of the turkey before it is cooked will help in giving a knowledge of the position of the joints.

# RECIPES FOR COOKING, ETC.

**WEIGHTS and Measures in Cooking.**—Weights and measures are essential in cooking, besides being often a great convenience for other purposes: but it is some trouble for a housekeeper always to be obliged to weigh everything where the recipe indicates weight, and an approximate standard or rule for guidance will frequently prove of great utility. Of course spoons, cups, tumblers, and even pint and quart measures vary to a certain extent. It will, therefore, be well to verify your measures by a sure standard, after which they may be used instead of weights for convenience. A tumbler, or ordinary coffee-cup full is half a pint. Eight tablespoonfuls of liquid measure a gill. A pint of granulated sugar is about a pound. Three half-pints of dry sifted flour are a pound. Four even teaspoonfuls make a tablespoonful. One very heaping teaspoonful makes a round tablespoonful. Eight round tablespoonfuls make half a pint. Two teaspoonfuls of cream-tartar should be used to one of soda, and a teaspoonful of soda to a quart of flour. For mixed spices, a good proportion consists of three heaping teaspoonfuls of cinnamon to one of clove, and two of nutmeg, or one heaping teaspoonful of ground mace instead. A half teaspoonful of allspice may be added in mixing for spiced cakes or puddings. When a teaspoonful is indicated without qualification, a spoon rounding full is meant; by a cupful an ordinary breakfast cup holding about half a pint. A broken half pint cupful of butter weighs nearly half a pound, while a solid half pint cupful weighs a full half pound.



FAMILY SCALES.

**Soups.**—Of all the operations of cookery, none are more frequently neglected or of more importance than the preparation of soups. Soups of all kinds are wholesome, and may be made very palatable, to say nothing of their economy as an article of diet. To commence a dinner with a light soup is decidedly conducive to health, being easily digested and nutritious, and seems to obviate the danger of eating too heavily of solid meat. The making of soups is an easy and economical way of using waste pieces of meat, and the bony pieces that cannot well be utilized by other methods of cooking. The richest soups are made by boiling several kinds of meat together. The seasoning for soups may vary almost infinitely, various spices, herbs, and vegetables being used. A teaspoonful of vinegar added to beef soup improves its flavor. Two or three onions and one or two carrots cut into small pieces and boiled tender are frequently added instead of the flour. A teacupful of ripe tomato cut into thin slices also makes a fine seasoning. When convenient, it is a good plan to make a soup the day before except seasoning, and set away to cool, after which the fat may be easily

removed. The next day put the liquid into a stew pan and let it come to a boil, and afterwards season. Soups should always be served hot.

**Barley Soup.**—Cut half a pound of mutton into small pieces, reserving all the fat; put it into a stew pan and add a quart of cold water and two tablespoonfuls of barley. Let it boil slowly, just simmering. Put the bones, if there are any, into another vessel with a pint of cold water, let them boil one hour, filling up with water, if necessary, so as to have about a pint of the liquid, then strain the water into the kettle with the meat and barley, and cook slowly two hours longer. Season with salt and pepper to taste.

**Beef Soup.**—Allow one pound of meat to a quart of water. Cut the meat in small pieces, and break or saw the bones. Remnants of cooked meats, such as steak or roasts, may be used in this manner. Add cold water and let it come to a boil slowly, after which let it boil moderately three or four hours, or until the juices of the meat are extracted. Then strain it off and place the soup back in the kettle and add salt and pepper to suit the taste, with a little brown flour to thicken, rubbed up with butter.

**Brown Soup.**—Brown one tablespoonful of flour; then put it in a bowl with a small lump of butter. Stir together to a smooth paste, and add one-half a pint of boiling water with a slice of toasted bread cut into small pieces, and salt to taste. This soup is both palatable and nutritious; and when animal food is forbidden, may be used as a good substitute for richer soup.

**Ox-Tail Soup.**—A large tureen of soup may be made from two ox-tails if large, or three if small. Wash them clean (not allowing them to soak in the water). Divide them at the joints, and put them in a stew pan with three quarts of cold water. Let this boil slowly until the meat is quite tender, which will be from two and a half to three hours. Remove the bones, cutting up the meat into very small pieces. Season with pepper, salt, celery salt, butter, and add a small quantity of brown flour to slightly thicken. Four onions, a small bunch of parsley, and a carrot sliced thin are frequently added to the seasoning.

**Tomato Soup.**—One quart of tomatoes, two tablespoons of flour, one teaspoon of salt, one of sugar, a pint of hot water. Let tomato and water come to a boil; rub flour, butter and a few spoonsful of the tomato together; stir into the boiling mixture; add salt and pepper; boil all together fifteen minutes; rub through a sieve and serve with toasted bread. To prepare bread for soups cut in thin slices; butter well; cut into squares; place on a pan in a hot oven for a few minutes. These are nice to serve with any soup or broth.—*Miss Parloa.*

**Vermicelli and Macaroni Soups.**—Two pounds of lamb and one pound of veal, from which all the fat has been removed; cut into small pieces and add three quarts of cold water. Boil slowly until the meat is cooked in shreds. Season with celery salt, common salt, pepper, and a half-teaspoonful of Worcestershire sauce; adding a heaping teacupful of vermicelli, or broken macaroni, and boil half an hour.

**Pea Soup.**—Take a pint of split peas, and when carefully picked over and washed, put them into a pint of water, soak in morning; three hours before dinner put them into a pot with a quart more water and about half a pound of pork (less if you wish the soup not very rich), boil it steadily and be careful to stir it often lest it should burn. It may need more water before dinner, and can be made of whatever thickness you prefer. If you prefer to have the soup without pork, use the liquor in which the beef or other fresh meat has been boiled instead of water, and use no pork.

**Turkey Soup.**—Take the turkey bones and cook for one hour in water enough to cover them, then stir in a little of the dressing. A little chopped celery improves it. Take from the fire, and when the water has ceased boiling, add a little butter, with pepper and salt.

**How to Broil a Steak.**—First see that the fire is clear and not too much of it; open wide all the draughts, to carry off all the smoke that is made during the process of broiling; then see that the gridiron is smooth and quite clean, lay on your steak. Do not pound it, nor, after it is on the fire, stick a fork into it, or the juice will escape. Neither salt nor pepper it; do that on the dish. Throw a little salt on the fire, and put over the steak; place the gridiron close on the range for the first few minutes, to carbonize the surface, so that the juices will not escape, then turn it over quickly, to carbonize the other side. Now it should be exposed to a slower fire. The steak should be turned repeatedly and carefully, and when it feels rather firm to the touch it is rare, and if so liked it should be taken off, laid on a hot dish, on which one and one-half ounces of butter have been melted, less than one half tea-

spoonful of salt, a pinch of white pepper, and one teaspoonful of chopped parsley, well mixed; lay the steak on one side, and then on the other. Serve immediately.

**Beefsteak Smothered with Onions.**—Cut up six onions very fine; put them in a saucepan with two cupfuls of hot water, about two ounces of good butter, some pepper and salt; dredge in flour. Let it stew until the onions are quite soft; then have the steak broiled, put into the saucepan with the onions; then simmer about ten minutes, and send to the table very hot.

Beefsteak is very palatable when served with fried onions. Slice the onions thin, and put them into a kettle of hot fat consisting of meat drippings the same as for frying doughnuts. Let them fry until brown and tender; strain out with a skimmer, letting the fat drip out well; broil and season the steak as above recommended, and spread the onions over it. Fat used for frying onions should, of course, not be used for cooking anything else, as it will have an onion flavor.

**To Brown Flour for Meat Gravies.**—Sift the flour and put it into an iron pan on the stove. Stir it constantly, scraping it up carefully from the bottom, never allowing it to stick or burn in the least, as it will give it a bitter flavor. Stir it rapidly and move it as it darkens, in order to get it browned perfectly even. When of an even nice brown color it is done. A quantity could be browned beforehand, and kept for convenient use in a glass or tin can. This, when used for thickening, gives certain meat gravies and brown soups a good color and flavor.

**Roast Meats.**—Meats require a hot oven for roasting; it is better, however, to have the oven moderately hot for the first ten or fifteen minutes, and be made hotter until the heat is quite brisk, than to have it very hot at first. After the meat is heated through, the heat should be well sustained until it is done. For a piece of meat weighing six to eight pounds, put a pint and a half of water in the roasting pan, with a teaspoonful of salt. More water without salt should be added as this boils away. Wash the meat in cold water, not allowing it to remain in the water to soak, wrap a clean, dry cloth around it to absorb the moisture, and rub evenly with fine salt. Do not dredge the meat with flour until it is two-thirds roasted, but continue to baste it with the water and meat drippings to keep it juicy and prevent it from getting crisp and dry. In doing this keep the door of the oven open as short a time as possible so as not to lower the heat. A cloth wound loosely around the hand and wrist, or an old gauntlet glove will protect from burning. Turn the pan around, or the meat in the pan, as required for even roasting. When about two-thirds done, draw out the roasting pan partly from the oven, and dredge it thoroughly and thickly over with fine sifted flour. When the flour is well browned (not before) baste it thoroughly with the gravy, and dredge in the same manner with flour again. Repeat this flouring and browning three or four times, being careful not to wash off the flour before it is browned, and the meat crisp, or to leave any unbrowned flour when it is taken out of the oven. Do not permit the water in the pan to dry out, as this is intended for the gravy. There should be a full pint or more of it. When done, take out the meat on a platter and cover and keep it hot. Set the roasting pan on the stove and stir all the scraps and flour from the dredging into the gravy as it boils. If not thick enough, stir in a little more flour. If there seems to be an excess of fat on the top of the gravy, dip it off with a spoon into another dish, being careful to take only the fat, and add a little more boiling water, stirring rapidly all the time to have it of a uniform thickness. Browned flour is best for this purpose. For roast veal, remove the bone if it be a leg, and fill the space with dressing, or if a loin, put as much of it under the flap as can be pressed into the space, and the rest in the corner of the stew pan, or it may be baked in a separate dish. Two or three thin slices of salt pork laid on the veal before placing it in the oven, enriches and flavors the meat. It should be removed just before dredging. All meats should be well basted while roasting. For the gravy for mutton or lamb, a little mint is excellent for seasoning.

**Dressing for Roast Turkey, Stuffed Veal, etc.**—A pint of finely pounded cracker crumbs, or stale bread that has become dry and chopped fine may be used as a basis of the dressing of roast veal, turkey, chicken, etc., to which may be added a full half cup of melted butter, with salt, pepper, pulverized sage, and summer savory to suit the taste. It is better to mix the salt, pepper, sage, and summer savory with the dry crumbs before adding the melted butter, which should be evenly stirred in. Stir in enough boiling water to make it into a stiff dough, afterwards beat one egg very light and mix it in. The egg can be omitted without serious detriment to the dressing—in fact some prefer it without. A few

thin slices of salt pork chopped so fine as to be as readily mixed with the crumbs as butter, are sometimes used in part for seasoning instead of all butter. The dressing for a roast goose is prepared like that for a turkey, except an onion finely chopped is added. A dressing for a roast goose is also sometimes made of finely mashed potatoes instead of crackers or bread crumbs, but the latter is generally preferred.

**Roast Turkey, Chicken, etc.**—Dress carefully and wash thoroughly in water slightly salted, and wipe with a clean. dry cloth. Put the heart, liver, and gizzard in a small sauce-pan, and covering well with water boil until tender. Prepare a dressing as previously described, filling the cavity of the body and the breast with it. Draw the skin well over the neck and tie it tightly with a small cord. The opening in the breast and body may be closed if necessary with a short skewer or a few stitches. Pass a long skewer under the leg joint between the leg and the thigh, then through the body under the opposite leg joint in the same manner, pressing the thighs upward and close to the sides of the fowl, then wind a string across around the ends of the skewer, and fasten it tight. The wings should be trussed up in the same manner, which will give the bird a plump and compact appearance. Cross the ends of the legs, and fasten them down to the tail, or they may be held down with a short skewer. Roast according to the directions for roasting meats, baking with the greatest care, and turning to have it brown evenly. It should be well cooked through and nicely browned before being taken from the oven. From an hour and three-quarters to two hours will be required for a turkey weighing eight pounds, and ten to fifteen minutes should be added for every additional pound. Of course much depends upon the intensity of heat in the oven. When done, dish it, removing the skewers and strings, and in preparing for the oven place the roast pan on the range, chop very fine the heart, liver, and gizzard that have been boiled tender, and with the water in which they were cooked add to the gravy in the pan, stirring in more flour, if necessary, for thickening. Ducks and geese are prepared for roasting in the same manner as chickens.

**Smothered Chicken.**—Dress a good-sized chicken as for roasting. Cut it open in the back, and spring the breast-bone back so that it will lie flat on the roasting pan. Wash it in salt and water, lay it in the baking pan with the outside of the bird up; rub it over with butter well mixed with flour, cross the legs and tie them, and cramp the wings. Pour over it a quart of water and set it in the oven to bake, dipping the gravy over it occasionally. When well browned turn it over and sprinkle the under side with flour and set it back in the oven. About fifteen minutes before it is wanted for the table, turn it over again with the breast up and dredge with flour again, letting it bake till it has an even brown and crisp appearance. If sufficient flour and butter were used to dredge the fowl, the gravy will be just right to serve without additional flour; if not, a little should be added. This makes a delicious dish for either breakfast or dinner.

**Baked Shad, Bluefish, Bass, etc.**—Make a dressing or stuffing the same as for roast meats, and after removing the scales and head, dress and wash out clean, drying with a cloth. Fill the body with the dressing and sew it up. Lay the fish in a baking pan, and add water and salt the same as for meat roasts, with the addition of a little butter, the water in the pan being about a half inch in depth. Baste the fish often, not permitting the skin to blister or burn, keeping up the supply of water in the pan by additions. Cook fully an hour. About twenty minutes before it is done dredge with flour, letting it brown; then baste and dredge again two or three times. It should be nicely browned when taken out of the oven. Gashing the sides of the fish about an inch apart, and laying in a very thin strip of fat salt pork, is sometimes done to add to the seasoning. The gravy that remains in the baking pan is thickened with flour, with the addition of butter, pepper, etc.

**Escalloped Oysters.**—One quart of solid oysters with every particle of sand and shell removed. Drain off the liquor, strain it, and add enough hot water to make a full half pint. Prepare a heaping half pint of fine cracker crumbs, with sufficient salt and pepper added to season. Mix half a cup of melted butter evenly with the seasoned cracker crumbs. Butter a deep dish and put in a layer of crumbs and moisten them with a few spoonfuls of the liquid; then cover these with a layer of oysters, repeating alternately the layers in this manner until all are used, and having a layer of cracker crumbs on the top. Bake from three-quarters of an hour to an hour, or until it is nicely browned. It may be necessary to add a few small pieces of butter on the top if the crumbs there do not seem sufficiently rich. A little hot water may also be added with a spoon if it seems too dry.

**Fried Oysters.**—Select the largest oysters, drain off all the liquor, dip in rolled cracker crumbs, and fry in equal parts of butter and lard until they are brown. Another method is to dip them in beaten egg and then in cracker crumbs before frying.

**Chicken Salad.**—Cut into small pieces two quarts of boiled or roasted chicken, free from skin, fat, and bone. Add four tablespoonfuls of vinegar, one teaspoon of salt, and a little pepper to suit the taste. For a dressing take the yolks of three eggs boiled hard; make them, fine and add two table spoonfuls of oil, one scant tablespoonful of mustard, one of sugar, and just enough of the liquor in which the chicken was boiled to moisten the salad nicely. Chop one quart of tender white celery. Keep separate on ice until just before serving, stirring the celery and chicken together. Arrange on a platter and garnish with the white leaves of celery. Half lettuce and half celery is sometimes used instead of all celery.

**Lobster Salad.**—This may be made in the same manner as chicken salad except using the lobster instead of the chicken. Another method: Four eggs, one tablespoonful of sugar, two of butter, one of salt, two of vinegar, one of mustard; beat the whites of the eggs separately, and add last. Cook in a bowl set in a kettle of water, stirring until it thickens. When cold add cream enough to make as thin as boiled custard. Add salt and red pepper to the chopped lobster, also chopped celery and lettuce. Set on ice until time for serving.

**Salmon Salad.**—One quart of cooked salmon, two heads of lettuce, two tablespoonfuls of lemon juice, one of vinegar, two of capers, one teaspoonful of salt, one-third of a teaspoonful of pepper, one cupful of mayonnaise dressing, or the French dressing. Break up the salmon with two silver forks. Add to it the salt, pepper, vinegar, and lemon juice. Put in the ice chest or some other cold place, for two or three hours. Prepare the lettuce as directed for lobster salad. At serving time, pick out leaves enough to border the dish. Cut or tear the remainder in pieces, and arrange these in the centre of a flat dish. On them heap the salmon lightly, and cover with the dressing Now sprinkle on the capers. Arrange the whole leaves at the base, and, if you choose, lay one-fourth of a thin slice of lemon on each leaf.—*Miss Parloa.*

**Fish Chowder.**—Four or five pounds of any hard, white fish; haddock, bass, cod, sword-fish; cut in small slices, and freed from bone and skin—Three or four slices of salt pork fried out, crisp, in the chowder kettle.—Two onions sliced and fried brown in fat.—Two or three more onions, sliced, raw.—Eight common-sized potatoes, boiled and sliced.—A dozen soft, or butter crackers, split. Take the fried onions out of the fat. Leave only fat enough to just cover, say *wet*, the bottom of the kettle. Put in a layer of fish; a layer of sliced potatoes; sprinkle some of the onion, both fried and raw, upon the potatoes; a "scatter" of pepper; a *careful* pinch of salt, as the pork will help to salt it; another layer of fish, potatoes, onions; the pepper and salt again; go on until the materials are half used, taking care to proportion the layers so that all may hold out together.

When half is used, scatter in a few small-cut bits or strips of the crisped pork, and cover with a layer of half crackers, inside down. Do the same when the remainder of the chowder is layered in, putting the split crackers over all. You may butter the crackers, or not, as you prefer. You may butter and *crisp* them, previously, if desired. These variations are points of taste. Cover once and a half deep with cold water, and set on where it will come to a boil. Boil gently and steadily one hour, keeping it where it will not burn. Pour in a cup of cream, and stir carefully, just before it is done. Having used salt very cautiously, taste and see if more is needed. Be careful also with pepper, and add that, if required. When you have not *cream*, it will certainly be well to butter the crackers. Use the best of the milk, at any rate.—*Mrs Whitney.*

**Clam Chowder.**—Same way, using clams instead of fish. Save all the clam liquor to help fill up with water in the kettle. Also, cut off the "*leather straps,*" when you trim the clams, and put them, not in the chowder, but in a saucepan, with just enough water to boil them, by themselves Add the broth thus gained to the chowder before taking up. Heads, of course, have been thrown away. To *open* clams, wash them clean, put them in a large pan or pot, with enough boiling water just to prevent from boiling dry and burning. A couple of quarts are enough for a bucket of clams. Cover them closely, that the steam may be kept in. As soon as they are well opened, take them off. Fifteen minutes will *cook* them, for serving as plain boiled clams. Dish up, and help as they are, in shells. Season with pepper, as you eat them, with lemon juice or vinegar.—*Mrs. Whitney.*

**Macaroni.**—Break the macaroni in pieces two or three inches in length. Put in cold water and let it stand on the cooking range until it boils ten minutes. Drain off the water and put the macaroni in a rather deep dish well buttered for baking. For twelve sticks of macaroni one egg well beaten and one-half pint of sweet cream or milk should be added. If milk, add a small quantity of butter, salt to taste, and turn it over the macaroni. Have half a cupful of grated cheese ready and sprinkle over the top just before setting in the oven. Let it brown nicely and be placed on the table in the dish in which it was baked.

**Sausages.**—To twenty pounds of meat chopped fine add eight ounces of salt, and a half ounce of saltpetre; one half teaspoonful of black pepper to every pound of meat, and one and one-fourth cups of finely pulverized sage to every ten pounds of meat. A little clove or allspice may be added to suit the taste. The meat for sausage should be mainly pork, about one-fifth fat; of the lean meat a fourth lean beef might be used instead of all pork if desired. The meat may be put in cases or packed in pans and sliced off for frying. A little partially melted lard spread over the top will help preserve the meat longer. Keep in a cool place.

**Codfish Balls.**—Soak pieces of salt codfish over night in cold water. Boil five minutes, remove all the bones and skin, and chop fine. To one part of fish add two parts of finely-mashed or chopped potato—that is, the fish should equal one-third of the material. Add sufficient butter, salt, and pepper to season well. To a pint of the chopped fish there should be two-thirds of a cup of melted butter and three or four tablespoonfuls of sweet cream or milk. Mix evenly and make into little balls, which flatten to about two-thirds of an inch in thickness. Beat an egg and slightly moisten the surface of the balls with it. Fry to a golden brown in half butter and half lard, or pork fat.

**French Fried Potatoes.**—Pare the potatoes nicely, and cut into several pieces lengthwise, making six or eight pieces of large ones and quarters of small ones. Drop into hot fat and fry the same as doughnuts. Care must be used to have the fat *hot* when the potatoes are first put in and keep it so, or they will soak fat; but if properly cooked in this way they will come out a nice brown, with no objectionable amount of grease in them, and make a delicious dish. Skim out and season with salt just before putting on the table.

**Cauliflower.**—Pick off all the leaves, wash the head of the cauliflower in cold water, and put it into boiling water, with a little salt for seasoning. Let it boil an hour steadily, but not furiously, so as to break it. When done take up carefully with a skimmer, put it on a dish, and pour over it a sauce made of cream, melted butter thickened with a little flour or corn starch, and seasoned with salt and pepper.

**Fried Onions.**—Peel the onions and slice them thin. Drop into a kettle of hot fat and fry the same as doughnuts until tender and brown. Skim out, taking care to drain out the fat, and season with salt and pepper.

**Mixing Dough.**—The best way to mix bread or dough of any kind is with a common chopping knife. It can be done much more quickly and easily in this manner, and saves the trouble of having one's hands emerged in sticky dough. Never melt the lard for pie crust, but mix it with the flour when cold, and wet with cold water.

**Wheat Bread.**—One quart of sifted flour. Have ready half a cupful of yeast. Make a hollow in the middle of the flour. To three-fourths of a pint of moderately warm water add two teaspoonfuls of white granulated sugar. We regard bread as sweeter and nicer flavored if salt is omitted. Pour the warm water gradually upon the yeast and flour, mixing with a chopping knife by turning and cutting until it is well mixed, and will cleave off the chopping knife readily without sticking. Dredge the moulding-board with flour; put the dough upon it, and dredge the dough and hands also with flour. Mould carefully at first so as not to have it adhere to the hands, and continue it until the dough is of an elastic and springy consistency, and will not stick to the hands or fingers if pressed into it. Put it in a bowl and cover with a clean napkin to keep out the dust. In cold weather set near the stove; in warm weather, away from it until it rises. Be careful that it does not overferment. There is a point in bread rising that requires attention; if it goes beyond this point it will lose its sweet, delicate flavor, although it may not be really sour. It therefore requires careful watching. Experience alone will enable one to readily detect the proper condition of the dough. When sufficiently raised chop and work the dough, at first until it will not adhere to the chopping knife; then turn it upon the moulding-board, mould as before, and make into loaves. Let it stand in the tins until it is raised sufficient for baking. Bread should be

uniformly a fine light, and not coarse and spongy, or with occasional large holes. It should be well baked, not burned, but baked thoroughly through, the crust to be uniformly a light golden brown. On removing from the oven, rubbing the outside over with a small piece of butter will make the crust tender. Avoid adding extra flour at the last moulding, as this will have a tendency to produce heavy or hard streaks in the loaf.

**Brown Bread.** — Take equal quantities of Indian meal and rye bran, a half cup of yeast, three-fourths of a cup of molasses (for a large loaf), a half teaspoonful of soda, and an even teaspoonful of salt. Mix with lukewarm water to a stiff batter. Let it rise an hour, and then steam three hours, the same as for steamed pudding, taking care not to let the boiling cease after the bread is put in. Afterwards bake ten minutes, or sufficient to form a light brown crust.

**Graham Bread.** — For two loaves, or two dozen muffins, one pint of water or milk, a half pint of wheat flour, and a pint and a half of Graham flour, half a cup of yeast, and the same of sugar or molasses, one teaspoonful of salt. Mix thoroughly, and let it rise an hour. It will require baking an hour.

**French Rolls.** — Take bread dough raised for the last moulding, and work into it a little lard or butter, sufficient to slightly shorten. Roll out the dough about an inch thick, and cut out the same as for biscuits. Rub a little butter on about one-third of the upper part of each, and fold it over on to the other portion. Let them rise about an hour; then bake to a light brown. These are excellent for breakfast when warm, and may be warmed over by setting a tin of them a few moments in the oven.

**Biscuit.** — Take a quart of sifted flour; add a teaspoonful of salt, one teaspoonful of soda, and two of cream tartar. Mix it evenly with the flour, which sift again to render the mixing more complete. If baking powder is used instead, add three even teaspoonfuls of that, and mix in the same manner. Afterwards add a cup of butter, not melted, but finely broken up into small pieces. Chop the butter with a chopping knife into the flour thus prepared, mixing and chopping until it looks uniformly yellow, like meal. Keep it cool, so that the butter will not melt; if it clings in solid lumps, it will make the biscuit heavy. Mix it with a scant pint of sweet milk. Roll out, and bake in a quick oven. Water may be used in place of milk, but milk is best. This is also nice for strawberry, raspberry, or orange shortcake. Another excellent recipe for biscuit, where cream is plenty, is to use a quart of pure, sweet cream for mixing and shortening the above, instead of the butter and milk.

**English Breakfast Cake.** — One egg, one tablespoonful of butter, one and a half cups of milk, one and a half cups of meal, one-half cup of flour, one tablespoonful of sugar, a little salt, two teaspoonfuls of cream tartar, and one of soda. Bake quickly, and it will be as light and tender as sponge cake.

**Lemon Pie.** — To three-fourths of a cup of cream, add the well-beaten yolks of three eggs, a full half cup of sugar, the juice of one lemon, and the grated peel of the lemon. For the frosting, the whites of three eggs, and one-fourth of a cup of pulverized sugar. Beat quick to a froth, and as soon as the pie is done, turn the frosting over it, and set it back in the oven for two or three minutes to lightly brown.

**Raisin Pie.** — Boil one pound of raisins an hour, covered with water. Add the juice of one large lemon or two small ones, one cup of sugar, and two tablespoonfuls of flour. This will make three pies.

**Cocoanut Pie.** — Three eggs well beaten, a half cup of sugar, a half cup of grated cocoanut, and a pint of milk. Bake without upper crust, the same as custard pie.

**Rhubarb Pie.** — Peel the rhubarb stalks, and cut into thin slices; fill the pies, alternating with layers of sugar and rhubarb. A cup of sugar will be required for one pie, as rhubarb is very tart. A few raisins will greatly improve the flavor. Dust a little flour (about a teaspoonful) over the upper layer before putting on the upper crust. Turn the upper crust under the edge a little, and press the two together, to prevent the syrup from boiling out. For the same reason, also, cut a large opening in the upper crust.

**Mince Pies.** — There are comparatively few housekeepers who know how to make *good* mince pies, and there are few articles of diet that are so unpalatable as mince pies that are not properly seasoned. The spices used should be according to taste, a mixture of all are generally preferred, consisting of cinamon, clove, allspice, mace or nutmeg, and a very slight sifting of pepper. Considerable salt will be required to bring out the flavors. The

following recipe is taken from Mrs. Whitney's cook book. We agree with her that butter is better than suet for mince pies, as it gives them a better flavor; but instead of mixing the chopped apple with the seasoned meat as soon as chopped, we should first thoroughly cook it to a soft pulp.

"The proportions of the following recipe are given as a good basis. When these are mixed, taste, and judgment must decide if the quantity of any of the ingredients would better be increased. I have kept far within the average limits of the cook books in respect to spices, for I always prefer to leave something to be added, and I believe in subdued undistinguished flavors, rather than those at all exaggerated or pronounced. You may use either suet or butter in preparing mince-meat. I like the latter myself and it is far less trouble.

Whatever further moistening may be needed, after using what is given in measure below, may be made up with any syrup you may have left from preserved fruit, water with jelly dissolved in it, as you would prepare for a summer drink, or molasses and boiling water, mixed half and half. The vinegar-syrup from sweet pickle is nice to help out the mixture. Or you may boil some vinegar-syrup on purpose,—equal measures of sugar and cider-vinegar. Just make the whole liquid mixtures a pleasant counteraction of sweet and sour, the *bright* taste prevailing. Be sure that there is salt enough to bring out all the other flavor. Often, when a higher flavor seems necessary the apparent tameness is only a deficiency of this. Salt may be used to the verge of *tasting* salt; never beyond.

Make ready,—at a convenient time beforehand,—for every two pounds of meat: Two pounds of fine raisins, stoned, and cut with a clean pair of scissors into bits, about three each.—One pound of dried currents, thoroughly washed, dried, and picked over.—Half a pound of citron cut in slips.

Make ready,—the day before you make your pies: A good fresh beef tongue, washed; put on in boiling water with a handful of salt in it, and boiled till perfectly tender. Try it with the knitting needle. When done, take it out, skin it, and return it to the hot liquor. Let all grow cold together.

If you use suet, take one pound to two of meat, pull off all the thin membrane, separating and picking over the pieces of suet thus detached, and chop it, in a cool place that it may not grow cloggy by melting, until it is as fine as dust. Set it away to keep cool till the meat is ready.

When the meat is cooked and cold, trim away from it all gristle and poor unpalatable parts, with bits of bone, about the roots. Weigh, of the nice selected portion, whatever quantity you wish to make into mince. I am giving measures of other ingredients suited to two pounds of meat, which will make as much mince, when all put together, as would ordinarily be worth while to prepare at one time. Chop this meat just as fine as you can. Now mix it thoroughly with the powered suet. *Or*, if you use butter instead, take a *short weight* pound for two pounds of meat, or measure a pint of broken butter, in pieces small enough to lie fairly close, but not packed. Melt it, stirring it till it liquefies. Then mix it with the chopped meat.

A fine housekeeper tells me, as I read this over to her, that a piece of nice salt pork perfectly fat, boiled about an hour to take away the rawness, and chopped fine, is an excellent substitute for suet. In chopping, put a little of the chopped meat into the tray with it to keep it from clogging.

Take four heaping tablespoonfuls of mixed spice.—Two heaping tablespoonfuls of salt.—Four heaping cups of brown sugar.—Grated rind of four large lemons. Mix well together, and all with the chopped meat. Take juice of the four lemons.—Two cups of molasses.—Two cups of boiled cider.—One cup of brandy, and one of wine.* Mix these together, and well into the mince meat.

Lastly, stir in your fruit, one kind after another, raisins, currants, citron, till all is equally mixed. Do all this stirring with your hand. Pack the mince into a bowl or jar, cover tight, and set away till the next day. Make ready, the morning of your pie-making, enough apple, chopped into jam, to measure twice as much as the chopped meat. Mix, with your hands, apple and meat thoroughly together. Now, if necessary, add moistening, according to suggestion in preliminary paragraphs. Make the whole as soft and moist as an easily stirred—not watery—sauce. Taste carefully, and see that salt and sugar are right, and use your own discretion as to increasing or modifying flavors. Remember the injunction in regard to flavoring soups: *Every condiment should hide itself, and help all the rest.* Make

*Equal measure of some spicy fruit and vinegar-syrup, as suggested above, will quite well substitute these two last,—be more economical, and less open to objection. Sweeten accordingly.

your crust by directions for best pastry. Fill and make up your pies the same as apple pies. Bake the crust handsomely; the meat is already cooked; and if the apples are mellow, juicy, and well chopped, they will be done also." Material for mince pies can be canned and kept for future use the same as fruit, if desired.

**Summer Mince Pie.**— Four large crackers rolled fine, one and one-half cups of sugar, one cup of molasses, one cup of vinegar or boiled cider, one cup of water, two-thirds cup of butter, one cup chopped raisins, two eggs beaten and stirred in the last thing, and spice to taste. Put some whole raisins on top of the pie before putting on the crust.

**Boiled Cider Pie.** — Take four tablespoonfuls of boiled cider, three tablespoonfuls each of sugar and water, two tablespoonfuls of flour, and one egg; beat all together. Add a few raisins. Bake in a deep plate, and with upper and under crusts.

**Queen of Puddings.** — One pint of nice bread crumbs, one quart of milk, one cup of sugar, the yolks of four eggs, the grated rind of one lemon, a piece of butter the size of an egg. Baked like a custard. When baked, spread over the top slices of jelly of any kind, and cover the whole with the whites of the eggs beaten to a stiff froth, with one cup of sugar and the juice of the lemon. Brown lightly in the oven.

**Steamed Pudding.** — Two-thirds of a cupful of chopped suet, rubbed into three cupfuls of flour, two-thirds of a cupful of molasses, one cupful of raisins, one cupful of sour milk, and one teaspoonful of soda; steam three hours. To be eaten with any sauce.

**Cottage Pudding.** — One coffee cup of sugar, one tablespoonful butter, two eggs, three cups flour, one cup milk, two even spoonfuls of cream tartar, one even spoonful soda. Bake like cake, and serve with sauce.

**Sauce for Steamed or Cottage Pudding.** — Two cups of water, one tablespoonful of butter, one tablespoonful of flour or corn starch blended with the butter, two-thirds cup of sugar, one tablespoonful of vinegar or sour wine. Flavor with lemon, vanilla, or nutmeg to taste. Let it come to a boil, and stir in the wine or vinegar and flavoring as it is turned out.

**Snow Pudding.** — One-half a package of gelatine, soaked in cold water for half an hour; afterwards turn off the water, and turn a cup of boiling water over the gelatine, stirring it rapidly till it is all dissolved. Squeeze the juice of one lemon into it, and strain it to take out all undissolved pieces of gelatine. Beat the whites of three eggs to a stiff froth, the same as for frosting, adding one cup of pulverized sugar; also add the dissolved gelatine, when perfectly cold, at intervals while beating. This pudding requires beating a long time, which should be continued without intermission until it will not fall out of the dish when turned over. Put in molds and set on ice, or in a cold place to harden. If kept cold while being beaten, it will come to a stiff froth much sooner.

**Sauce for Snow Pudding.**—The sauce for snow pudding should be made of the yolks of three eggs made into a soft custard and flavored with vanilla or lemon extract.

**Bird's Nest Pudding.**—Pare tart apples sufficient to fill a pudding-dish. Make a batter of one quart of milk, three eggs, two cups of flour. Pour over the apples, and bake in a quick oven. Eaten with a sauce.

**Blanc Mange, or Corn Starch Pudding.**—Four heaping tablespoonfuls of corn starch, the same quantity of sugar, and one quart of milk. Dissolve the corn starch and sugar in a small quantity of milk to prevent its being lumpy. Scald the milk and stir in the corn starch batter rapidly until it is well cooked to prevent lumps forming. Add a dessert spoonful of lemon or vanilla extract, and turn into moulds to cool. Keep in a cool place until wanted for the table. Serve with sugar and cream.

**Tapioca Pudding.**—One teacup of tapioca soaked over night in water. One quart of sweet milk, one cup of sugar, one-half cup of raisins, the yolks of four eggs, and a pinch of salt. Flavor with lemon, bake one hour, beat the whites of four eggs to a froth with two tablespoonfuls of pulverized sugar, and turn it over the pudding after baking, then set it in the oven a few minutes to lightly brown.

**Sponge Cake.**—Four eggs, one cup of sugar, two teacups of flour, two teaspoonfuls of cream-tartar, and one of soda; or three teaspoonfuls of baking powder, if that is used instead. Beat the eggs and sugar, add the cream-tartar and soda to the flour, mix it well

and sift it again. Beat all together, and add vanilla or lemon extract for flavoring. Then add two-thirds of a cup of water the last thing, and beat thoroughly, turn into a well buttered dish, and bake in a quick oven.

**Grinnel Cake.**—One and one-half cups of sugar, two and one-half cups of flour, one cup of sweet milk, one-half cup of butter, two eggs, one teaspoonful of soda, and two of cream-tartar. Beat the eggs and sugar, adding the milk and flour afterwards. Divide this mixture, half and half. Flavor the light part to suit the taste; with the other part one cup of chopped raisins, and one full teaspoonful each of cloves, mace or nutmeg, and cinnamon. Bake separately in the same sized tins, frost both loaves, and place the light colored loaf on the dark one while the frosting is soft. This is very nice.

**Loaf Cake.**—Three cups of milk, and one of yeast; make a stiff batter and let it rise very light; then add two cups of sugar, one and three-fourth cups of butter, two cups of raisins and two eggs, with spices to suit the taste. Mix thoroughly and put in well buttered tins to rise again before baking.

**Silver Cake.**—Two cups of sugar, one-half cup of butter, three cups of flour, one cup of sweet milk, the whites of three eggs, one teaspoonful of soda, and two teaspoonfuls of cream-tartar. Flavor with lemon extract. This makes two loaves.

**Gold Cake.**—The same as the above, using the yolks of the eggs instead of the whites. Flavor with vanilla.

**French Cake.**—One cup of sugar, one-third cup of butter, one cup of sweet milk, one and a half cups of flour, one egg, two teaspoonfuls of cream-tartar, one teaspoonful of soda. Flavor with extract of lemon or vanilla.

**Jumbles.**—One and a half-pounds of flour, one pound of sugar, one-half pound of butter, four eggs. Mix the sugar and butter, then add the eggs and flour, and a little sweet milk if the eggs are not sufficient. Roll out and bake in a quick oven.

**Fruit Cake.**—One a half-cups of butter, three cups of sugar, four and two-thirds cups of flour, one cup of milk, six eggs. two teaspoonfuls of cream-tartar, one of soda, one teaspoonful of nutmeg, two of cinnamon, and one each of cloves and allspice. Two pounds of chopped raisins, two pounds of currants, and one-fourth pound of citron. This makes two loaves.

Another recipe considerably richer: One pound of flour, one pound of butter, one pound of sugar, ten eggs, three pounds of stoned and chopped raisins, one pound of currants, one pound of citron, two nutmegs, two full teaspoonfuls each of cloves and other spices, one teaspoonful of saleratus, and about a gill of molasses.

**Snow Cake.**—Two cups of fine granulated sugar, one cup of butter broken into small pieces, one even cup-full of flour, and four tablespoonfuls of corn starch sifted together, whites of twelve eggs, juice of one lemon. Flavor with two tablespoonfuls of rose-water, one teaspoonful of lemon extract, or half a teaspoonful of essence of bitter almonds. Beat the butter and one-half of the sugar together, then beat the whites of the eggs to a stiff froth, adding the rest of the sugar; drop the butter and sugar into the flour, turn the eggs and sugar upon it and beat thoroughly. Bake in a quick oven. Flavor the icing with rose-water or lemon.

**Angel Cake.**—The whites of eleven eggs, one and a half-cupfuls of granulated sugar, one cupful of pastry flour, measured after being sifted four times; one teaspoonful of cream-tartar, one of vanilla extract. Sift the flour and cream-tartar together. Beat the whites to a stiff froth. Beat the sugar into the eggs, and add the seasoning and flour, stirring quickly and lightly. Beat until ready to put the mixture in the oven. Use a pan that has little legs at the top corners, so that when the pan is turned upside down on the table, after the baking, a current of air will pass under and over it. Bake for forty minutes in a moderate oven. Do not grease the pan.—*Miss Parloa.*

**Sunshine.**—This is made almost exactly like angel cake. Have the whites of eleven eggs, and yolks of six, one and a half-cupfuls of granulated sugar, measured after one sift; one cupful of flour, measured after sifting; one teaspoonful of cream-tartar, and one of orange extract. Beat the whites to a stiff froth, and gradually beat in the sugar. Beat the yolks in a similar manner, and add to them the whites and sugar, and the flavor. Finally sift in the flour, mix quickly and well. Bake for fifty minutes in a slow oven, using a pan like that for angel cake.—*Miss Parloa.*

**Icing and Ornamenting Cake.**—The following directions on this subject are given by a writer in one of our leading Agricultural Journals, and will be found useful to many housekeepers:

THE ICING.—"Whatever the decoration, the cake has first a coating of plain icing as a foundation. This preparation is merely the white of eggs and powdered sugar beaten together; as eggs differ in size, and as the temperature has an effect on the icing, no rigid rule can be given. It should be of a consistence that can only be learned by practice; it should not be thin enough to run, nor should it be so thick that, on standing, the surface will not settle and become smooth. The usual rule is: One pound of powdered sugar to the whites of four eggs; if lemon juice or extract of lemon or vanilla is added for flavoring, more sugar will be required to make up for this added liquid. The whites being placed in a shallow bowl, a little sugar is added, and the two are beaten with a whisk or egg-beater, the beating is kept up regularly, adding the sugar by degrees. If the eggs are large three will be enough for a pound of sugar. The beating and addition of sugar must go on until the icing is of the right consistence—and only experience and judgment can decide what the proper stiffness is.

TO APPLY THE ICING.—The inexperienced should wait until the cake is cold, but those who are skilled apply the icing while it is still quite warm. The side of the cake is iced first; a piece of card-board, not too coarse and stiff, but about like Bristol-board will be required, as this may be curved to suit the surface of the cake; it should be about four inches long, and of convenient width to handle; the icing is to be applied to the sides with a knife, and smoothed and spread evenly by the use of the card-board, carrying the icing well up to the edge. For the top, place what may be required in the centre and spread it down towards the edges, by means of the card board; if the icing is very stiff it may need to be smoothed by the use of a broad-knife dipped in water.

ORNAMENTATION.—The materials used for ornamenting the surface are of two kinds: 1. The icing itself; and, 2d, sugar paste, to be presently described, from which ornaments not possible with icing may be made to be attached to the surface.

THE USE OF ICING depends upon the skillful direction of a small stream of the material; syringes are sold at the furnishing stores for this purpose, but the regular decorators use a very simple affair. A coil is made of stout, well-glazed writing paper, like a confectioner's or grocer's horn, or cornucopia; this should be made very narrow at the point, and the paper go around two or three times. A quantity of the icing is placed in this, and the top edges are folded over; of course a pressure upon this will force the icing out at the point below, and great care must be taken to regulate the size of the hole there; the point is made purposely long, and by cutting off a bit of the paper at the end, the opening may be gradually enlarged. One of the commonest ornaments is the 'drop.' Squeeze out enough icing to form a drop, say the size of a pea, touch this to the iced surface of the cake, and lift the horn, and it will leave a neat drop. By squeezing gently the top of the horn, a continuous stream will be forced out; this may, by moving the horn along, be laid straight, or by giving it a regular side to side motion it will form a waved line. By giving the stream an up and down motion, scallops will be the result.

BY COMBINING these simple elements, the drop, the straight line, the waved line, and what we may call the furrowed line, a great variety of ornaments may be made, in the hands of an ingenious person all that may be desired in a home product. The line may be run to form a great variety of figures, such as hearts, leaves, initials, and monograms, etc. A very simple, but quite effective border may be made by the waved line run all around the edge of the cake, and a drop placed in each curve. By having two horns, one having a larger and the other a very fine stream, very pretty effects may be produced. Suppose a heart or a star has been made with the larger stream, then take the other, which should have a very fine point, and give a thread-like stream, and run lines across within the figure, very near together, in one direction, then cross-wise at right angles; this will give the effect of lace-work. Some times the whole surface of the cake is covered with lace-work in this manner, and the larger figures laid over it.

PRECAUTIONS TO BE NOTED.—Have the icing so stiff that when it runs out of the horn it will retain its shape. In using the horn always press from the upper part downwards; as the icing is used up the top of the horn may be rolled down towards the point. Recollect that it is much easier to enlarge the hole at the point, than to contract it. Try first any new design upon a piece of clean paper.

**Ornaments with Sugar Paste.**— The paste is a sugar dough, made with powdered sugar and mucilage of gum tragacanth. To make the mucilage, take an ounce of the whitest gum tragacanth, and pour over it a pint of boiling water. Let this stand in a warm place, occasionally stirring, for a day. Tragacanth does not *dissolve*, it only swells to a paste; if not thin enough, add more boiling water and stir. The lumps must be strained out by squeezing through a coarse fabric. Use this strained mucilage and powdered sugar, mix and beat together—a mortar would be convenient, but it may be done on a moulding board, with a plenty of powdered sugar to keep it from sticking—as much sugar as a given quantity of the mucilage will take up and form a stiff dough that can be rolled out thin. From this dough or paste, by means of cutters, formed of strips of tin bent to the desired shape, leaves, parts of flowers, or other ornamental forms may be cut; this may be formed and moulded into any desired shape, and the raw material from which the most elaborate ornaments are fashioned. These ornaments may be attached to the surface of the cake with little of the mucilage, or where there is a flat surface, by merely wetting them; parts of the paste ornaments may be joined to one another in a similar manner.

Do not roll out any more of the sugar-paste than can be used at once, for as soon as dry it is as brittle as glass, and very hard. Keep the mass covered with a damp cloth. Have a definite idea of what is to be made, so that the paste ornaments can be put into shape quickly, before it dries. The surface of leaves, etc., may be figured at will by drawing veins, etc., upon it with some hard blunt point. Those who understand making wax or other artificial flowers, can fashion this paste into a great variety of forms. We have not provided for any colored or gilded ornaments sometimes used on cakes, as pure white throughout is much more pleasing to persons of taste."

**Ice Cream.**—Ice cream can be made in various ways with or without cooking the milk and eggs, also with sweet cream or without. Of course the richest is where the pure cream is used. That which is made into a soft custard before freezing is much the finest grained, and nicest. The following is an excellent recipe: Two quarts of rich sweet milk (part cream preferred), beat six eggs to a froth, the same as for custard, and add a cup of granulated sugar. mix it with the milk, and set the vessel containing it in a larger one containing water; stir constantly until it begins to thicken, but not to separate the whey. Take off and when cold add two teaspoonfuls of lemon or vanilla; then freeze, stirring rapidly to have it freeze evenly and make the grain fine.

**Velvet Cream.**—Two-thirds of a box of gelatine soaked in cold milk until it is soft. Scald a pint and a half of rich milk (part cream is better) in a double boiler, and turn the gelatine and milk into it, stirring rapidly. After the gelatine is all dissolved, stir in half a cup of sugar. Take from the fire and beat it very light; as the cream cools add a teaspoonful of vanilla or lemon extract. Beat the whites of three eggs to a froth, the same as for frosting, and when nearly cold beat in with the cream till it is all of an even froth. Then turn into wet moulds and put in a cool place to harden.

**Soft Custard.**—One quart of milk, one scant half teacupful of sugar, half a teaspoonful of salt, five eggs, one teaspoonful of lemon or vanilla extract. Beat the sugar and eggs together and add the milk and salt. Put it in a vessel and set it in another of hot water (or use a double boiler). Stir rapidly until it begins to thicken. Do not let it separate into curd and whey, but take it off just before it comes to this point. When cold add the flavor. Serve in custard glasses.

**Jellies.**—An ounce and a half package of Coxe's Gelatine makes three pints of water, fruit juice, or any other jelly. A package of gelatine measures a gill and a half, or about six round tablespoonfuls. When sea moss is used, a full tablespoonful will make a quart of jelly. One cupful of sago or tapioca will make a quart of jelly. Three tablespoonfuls of arrow-root or corn-starch will make a quart of jelly. Allowance should be made for wine, lemon juice, etc., used, and be deducted from the quantity of water used.

**Lemon Jelly.**—Soak a package of gelatine in a pint of cold water until it is softened to a jelly consistency, which will take from half an hour to an hour. Grate the rind and squeeze the juice of three good sized (four of small) lemons, add a scant teacupful of granulated sugar to the lemon juice and grated peel. Pour a pint and a half of boiling water to the lemon and sugar, and quickly add the softened gelatine. Stir until the gelatine is all dissolved, then strain it through a cloth strainer into moulds or a bowl to cool. Set on ice or in a cold place to harden.

**Orange Jelly, Strawberry Jelly, etc.**—Any fruit jelly for immediate use, such as lemon, orange, strawberry, raspberry, etc., can be made similar to lemon jelly, as previously given. Except when oranges are used, the juice of one lemon should be added, if the oranges are sweet; and in strawberry jellies, etc., the juice of the fruit is used for flavoring. Three pints of ripe strawberries, a box of gelatine, a pint of boiling water, and a half pint of cold water, and sufficient sugar to sweeten to taste are required. Soak the gelatine in cold water as directed for lemon jelly, mash the berries with the sugar (about a pint, according to the acidity of the berries), and let them stand two hours. Pour the boiling water on the crushed fruit and sugar; press the juice from the berries and add it to the dissolved gelatine, stirring it well. Strain through a napkin, and pour into moulds to harden, that have been set in cold water. If the strawberries are very sweet, it will improve the flavor to add the juice of a lemon.

**Charlotte Russe.**—One-half pint of thick cream whipped to a froth, the whites of two eggs beaten to a froth, one cup of water with two spoonfuls of gelatine dissolved in it; sweeten to taste and flavor with vanilla or lemon. One loaf sponge cake, take a deep dish, line the dish with small strips of this cake, and pour the cream into the middle of the dish, put writing paper on the bottom of the dish. Let it remain until hardened; turn it out on a flat dish.

**Floating Island.**—Make a soft custard and let it get cold. Beat the whites of three eggs to a stiff froth, adding a third of a cup of pulverized sugar. When the custard is perfectly cold, turn the frosting over the custard.

**Sugar Kisses.**—Whites of two eggs, beaten as for frosting; one cup of sugar added to them. Mix well, add a teaspoonful of any kind of flavoring desired, and drop in small cakes on a buttered tin. Bake in a moderate oven until lightly touched with brown.

**Chocolate Cream Drops.**—One cup of water, two of sugar, a pinch of cream of tarter; boil ten or fifteen minutes; beat it into a cream; let it cool a little, and then roll up into balls any size you wish, then place them on a thick paper to cool a little more; melt one-quarter of a pound of chocolate, and dip the balls into it while hot, then place them on a paper to cool.

**Ice Cream Candy.**—Two pounds of coffee-crushed sugar, one pint water, two tablespoonfuls of vinegar, a pint of butter; boil, but do not stir. When done enough to harden in water, add one teaspoonful of vanilla. Cool a little in plates, then work as molasses candy till white.

**Chocolate Caramels.**—One cup each grated chocolate, sweet, fresh milk, molasses, and brown sugar, a piece of butter the size of an egg; boil until it drops hard; pour it into a buttered pan, and before it cools mark it off in squares.

**Cocoanut Dessert.**—Place a layer of sliced oranges in a deep dish, sprinkle over with fine white sugar, then a layer of finely grated cocoanut; alternate orange, sugar, and cocoanut until the dish is full, heaping the cocoanut on top.

**Canning Tomatoes.**—Select perfectly ripe tomatoes, pour boiling water over them. When scalding them do not allow them to stand any longer in the hot water than is necessary to have the skin peel off easily. Peel as soon as possible after scalding, and quarter (not slice) them into a vessel, to stand an hour or so before canning. Drain off all the surplus water, as it is this liquid which causes so many tomatoes to become sour after canning. Boil them until they are cooked through perfectly; then fill the cans full—the cans having previously been heated with hot water—put on the covers quickly and turn them down tight. When perfectly cold, turn the covers down still tighter, if possible.

**Pickled Cucumbers.**—The cucumbers should be small, not more than two or three inches in length. Put them into a tub with a layer of salt and cucumbers alternately. Turn on boiling water and let them stand ten or twelve hours. Take out from the salt water, and turn boiling water over them, letting them stand till the water is cold; then take out and put in a jar, and cover with vinegar. Pickles prepared in this manner will be crisp and brittle, and require no alum or other injurious substances to make them so.

**Tomato Chow Chow.**—Slice one peck green tomatoes, six green peppers, four onions; stir in a cup of salt, and let them remain over night. Then pour off the water, put them in a kettle with vinegar enough to cover them. Add one cup of grated horse-radish, one tea-

spoonful of cloves, one tablespoonful of cinnamon, one tablespoonful of allspice, one cup of sugar; cook until soft.

**Tomato Catchup.**—Eight quarts of strained tomato, six tablespoonfuls of black pepper, six tablespoonfuls of salt, four tablespoonfuls mustard, one tablespoonful ground cloves, one tablespoonful yellow ginger, one quart vinegar, one-half cup of brown sugar, one tumbler of brandy. Boil very slowly until the quantity is reduced nearly one-half. Put into bottles.

**Spiced Currants or Blackberries.**—Seven pounds currants, four pounds sugar, one pint vinegar (if of average strength), one tablespoonful of cinnamon, one tablespoonful of cloves, one teaspoonful allspice. Give it two hours or more slow boiling.

**Blackberry Wine.**—Mash the berries and pour one quart of boiling water to each gallon; let the mixture stand twenty-four hours, stirring occasionally; then strain and measure into a keg, adding two pounds of sugar to each gallon. Let it stand until done fermenting; then cork it tight, or draw it off and bottle. Another good recipe for blackberry wine is as follows:—Measure the berries and bruise them. To every gallon add one quart of water, and let the mixture stand for twenty-four hours, stirring occasionally; then strain off the liquid into a cask, adding two pounds of sugar to every gallon of the mixture. Let it stand till the following October, when the wine will be ready for use without further straining or boiling. It may be improved, and perhaps kept better, by adding a small quantity of pure French brandy.

**Elderberry Wine.**—To every quart of berries add one quart of water; boil half an hour; run off the liquor and break the berries through a hair sieve; then to every quart of juice add three-quarters of a pound of sugar; boil again one quarter of an hour with ginger. and a few cloves. When sufficiently cool pour into a barrel with a cup of yeast and a piece of toast to assist the fermentation (to be kept in a warm place). When it ceases to hiss, add one quart of brandy to eight gallons of the liquor; then close the barrel perfectly air-tight and keep in a cool place for six months, when it will be fit to bottle. Another for elderberry wine:—To one gallon of the ripe berries add one of water; let it stand twenty-four hours, stirring it often; boil it half an hour in a copper or brass kettle, and strain through a sieve. Put it again in the kettle, and to each gallon of liquid add three and a half pounds of sugar; boil it twenty-five minutes. Tie in a cloth half an ounce of ginger. the same of allspice; put it into the kettle and boil five minutes; then take out the spice. When cool add one teacupful of good yeast; keep it in a warm room to ferment a few days; then put it into a cask with the bung out for three or four months, when it will be ready to bottle. Wine made by this recipe is equal in flavor to port wine, and is far more wholesome for medical purposes than any commercial wine.

**Recipe for Brown's Troches.**—Pulverized liquorice two and a half ounces; pulverized gum arabic two ounces; pulverized cubebs one ounce; pulverized sugar one pound. Mix thoroughly with a very little water, being careful not to put in too much. Reserve about half of the gum arabic to roll the mass out in. Roll out thin like stiff dough, cut out in any desirable form and dry.

**Care of House Plants.**—Plants add much to the cheeriness and attractiveness of a room in winter, and to one who loves them, they seem to promote companionship and sympathy.

Dust.—One great enemy to house plants is dust, and all smooth leaved plants, like ivy, cape-jessamine, camellias, etc., should have their leaves washed on both sides in lukewarm water with a soft sponge or cloth. This should be done at least once a week. Rough leaved plants, like geraniums, and some others, cannot be washed to advantage, and these should be set in a sink or bath-tub and have their leaves washed with a watering pot held high up from the plants, so that the water may beat off the dust. When the under side of the leaves are to be washed, turn the pot over on its side, so that the under side of the leaves may be readily reached. Before sweeping, it would be well to cover the plants with a light cloth or newspaper to prevent the dust settling on the leaves.

Insects.—"If one allows insects to get the mastery, the case is difficult; but if the plants as soon as brought in-doors have proper attention, insects need give but little trouble. The three great remedies for insects upon house-plants are—the fingers, tobacco, and water. One who loves plants and watches them, will note the first appearance of scale, mealy-bug, or

other insect large enough to be readily seen, and remove it. Scale may be readily removed by a blunt knife, and mealy-bug may be picked off by a match whittled to a point. Keep a supply of tobacco-water made by pouring boiling water upon tobacco stems of any cheap kind of tobacco. When used, this is to be diluted, as the rule goes, 'to the color of boarding house tea.' Diluted in this manner it may be showered upon plants infested with plant lice. Preferably, it may be placed in a keg or tub, and the plants infested with insects dipped in it for a few seconds, moving them gently about. The most troublesome of all insects in dry rooms is the red spider, a minute mite which attacks the undersides of leaves. When the leaves of a plant turn brown, red spider is the probable cause. A frequent application of water, as mentioned under dust, is the remedy. In this case, lay the pots on their sides so that the water will reach the under surface of the leaves.

Too Much Water is another lack of success with house plants. If a plant is not in flourishing condition the common remedy is water, and it is watered again and continuously until the soil in the pot is merely mud, in which only the roots of aquatic plants can live. Vastly more house plants are injured by too much than by too little water. There is but one rule for giving water to house plants, that is—give water when it is needed. There should be no indiscriminate daily watering, drenching all alike. It is far better for a plant to get occasionally a little dry, and for its leaves to flag and droop, than to keep its roots soaked by an excess of water. The soil in the pots of house plants should be moist, like that of good garden soil just below the surface. If in this condition no more water is needed. One by observing the soil, its color, and the manner in which it feels when pressed by the finger, can soon learn to judge whether water is needed or not. Another frequent trouble with house plants is

Worms in the Soil.—Every one who cultivates house plants should learn to readily remove the ball of earth from the pot, so that it can be inspected. By exposing the ball, the large earth worms may often be seen upon its surface, and can be picked off. These, as well as smaller worms that sometimes infest the soil, may be readily killed by the use of lime-water. Slake a piece of lime as large as the fist in a pail, and when slaked, fill the pail with water, stir, and let it rest. Use the perfectly clear water upon the soil in the pots.

By observing these precautions as to dust, insects, and watering, the window cultivation of plants will be comparatively easy. Not only for the health of the plants, but of that of the inmates of the dwelling, the air, however heated, should be moistened by proper provision for the evaporation of water.

Even in localities where winters are severe, there are not many days in succession in which the window may not be opened for a short time in the middle of the day. All such opportunities for giving the plants fresh air should be utilized, and what is good for the plants will not injure those who care for them." A little ammonia put in the water for watering plants two or three times a week, will make them thrifty, and grow rapidly.

**To Exterminate Bed-bugs, Moths, Cockroaches, Red Ants, etc.**—Bed-bugs, Moths, and other insects may be easily exterminated by a free use of benzine. The pure benzine will not soil or injure mattresses or the upholstering of furniture, and may be freely applied; but care should be used not to apply it to painted or varnished woods. Naphtha is of the same nature as benzine, but much more powerful, and when it can be procured is to be preferred. Avoid the use of either benzine or naphtha near a flame, as they are exceedingly volatile. The best method of exterminating red ants, that are such a pest to many housekeepers, is to find the place where they enter the house, if possible, and track them to their nests, which, when found, deluge with boiling water, kerosene oil, or benzine; doing this frequently for a few days will exterminate the entire colony. Some persons have used the oil of pennyroyal with success.

**To Remove Fresh Ink Stains from Carpets, etc.**—When ink has been spilled upon a carpet, apply as quickly as possible, and before it has time to become absorbed into the meshes, common table salt in sufficient large quantities to absorb the ink. Then sweep it up and apply a new supply of salt, continuing to do so until the salt applied is not soiled by the ink. To remove old or fresh ink stains from white material of any kind, apply oxalic acid, and rinse in warm water; if applied to colored goods it will remove not only the ink stains but other colors also. To remove fruit or tea stains from napkins or other table linen, place the stained parts in an earthen bowl, and turn *boiling* water directly on to them, letting them remain in the water until cold. Be sure the water is *boiling*, as simply hot water will set the stain in, instead of removing it.

**To Prevent Lamp Chimneys from Cracking.** — The following treatment will not only render lamp chimneys, tumblers, and like articles more durable, but may be applied with advantage to crockery, stoneware, porcelain, etc.: The chimneys, tumblers, etc., are put into a pot filled with cold water, to which some common table salt has been added. The water is well boiled over a fire, and then allowed to cool slowly. When the articles are taken out and washed, they will be found to resist afterward any sudden changes of temperature. The process is simply one of annealing, and the slower the cooling part of it is conducted the more effective will be the work.

**How to Clean Lamp Burners.** — When lamp burners get gummed, and will not turn the wick up readily, boil them for two or three hours in strong soap suds. They will then turn the wick as readily as when new.

**To Renovate Black Silk.** — Black silk is restored to its deep black color by sponging it with a strong decoction of cheap black tea. Turn the silk wrong side up, place a thin cloth over it, and smooth out with a moderately hot iron.

**To Wash Black Lace.** — Put the lace in alcohol, using no water. Squeeze it out, but do not rub it at all. Change the alcohol until it looks clear. Make the last quantity of alcohol pretty blue from common washing bluing or indigo. Squeeze out the lace, fold several thicknesses of cloth on a table, and lay out the lace smoothly to dry, or pin it if necessary to keep it smooth. Do not iron it, but press it between heavy books or other weights when nearly dry.

**Sand Bag for the Sick Room.** — One of the most convenient articles to be used in a sick room is a sand bag. Get some clean, fine sand, dry it thoroughly in a kettle on the stove, make a bag about eight inches square of flannel, fill with the dry sand, sew the opening carefully together, and cover the bag with cotton or linen cloth. This will prevent the sand from sifting out, and will also enable you to heat the bag quickly by placing it in the oven, or even on top of the stove. After once using this, you will never again attempt to warm the feet or hands of a sick person with a bottle of hot water or a brick. The sand holds the heat a long time, and the bag can be tucked up to the back without hurting the invalid. It is a good plan to make two or three of the bags, and keep them ready for use.

**Antidotes for Poisoning.** — If poison has been swallowed, try to produce vomiting *immediately*. This can be done at once by giving the patient a tumbler of lukewarm water containing a tablespoonful of ground mustard. Common salt will sometimes answer the place of mustard, if that is not at hand; but the mustard is to be preferred. If the first is not effectual (although it generally is), take a second dose. When vomiting is difficult to accomplish, tickle the back of the throat with the finger, or with a feather, and repeat the use of hot water. In all cases of poisoning, prompt action is very essential. Never wait to send for a physician before relieving the patient. All poisons should be properly labeled and kept under lock and key apart from all other medicines; if this precaution were always taken, fewer deaths by accidental poisoning would occur. Matches should be kept out of the reach of young children, as the phosphorus contained in them is very poisonous.

**Arsenic.** — If a person has been poisoned with arsenic, administer the mustard water until vomiting is produced; after freely vomiting, give the patient dialyzed iron — a tablespoonful every five minutes until six doses have been taken — or a teaspoonful of sulphur.

**Oxalic Acid.** — Oxalic acid resembles epsom salts, and is liable to be taken in place of the latter by mistake. The two can be easily distinguished from each other by touching a little to the tongue. Epsom salt has a very *bitter* taste, while oxalic acid is *very sour*. Give a full tablespoonful of either magnesia, pulverized chalk, carbonate of soda, or saleratus, dissolved in water. Use a stomach pump if one is to be obtained.

**Sugar of Lead.** — For an alkaline poison, such as sugar of lead or acetate of lead, give the mustard emetic as above recommended, together with vinegar and water. This may sometimes be followed with benefit by a dose of either epsom or glauber salts.

**Strychnine.** — Give to a person poisoned with strychnine an emetic of mustard and warm water, to be followed after vomiting freely by a drink of vinegar and sweet oil. Rich, sweet milk is also good instead of the latter.

**Corrosive Sublimate.** — When poisoned with corrosive sublimate, give whites of eggs, milk, or oil, as much as the patient can take; then give the mustard water emetic, as previously recommended.

**Nitrate of Silver.** — When poisoned with nitrate of silver or lunar caustic, give a tablespoonful of common salt in a large tumbler of water, to be followed by castor oil.

**Strong Lye.** — When strong lye has been swallowed by mistake, as it sometimes is by children, give olive oil or vinegar, or a teacupful of thin, sweet cream. This will neutralize, in a great measure, the effect of the lye. By following it with a mustard emetic, the stomach will be relieved of its contents, although the soap formed by the mingling of the oil and lye, or the acetate of potash by the vinegar and lye, will not materially injure the stomach.

**Poisoning by Ammonia.** — Perhaps it is not generally known that water of ammonia or hartshorn, if taken in an undiluted state into the stomach, acts as a violent poison. When this accident happens, give vinegar *instantly*, mixed with a little water. This will neutralize the effect of the ammonia, since vinegar is an acid and ammonia is an alkali.

**Poisoning from Matches.** — Children sometimes become poisoned by eating off the ends of matches, which are composed of very poisonous substances, the principal being phosphorus. Give an emetic of mustard and lukewarm water as quickly as possible, and send for a physician.

**Opium, Morphine, Laudanum, etc.** — When a person has been poisoned by opium, morphine, laudanum, paregoric, nux vomica, aconite, belladonna, veratrum viride. or croton oil, give an emetic of ground mustard and water immediately, and continue till free vomiting is produced. Then follow with a drink of vinegar and sweet oil. If any of the above poisons produce drowsiness or numbness, rub the body and limbs and soles of the feet with a stiff flesh brush or crash towel. Keep him in the open air, and walking if possible; dash water in his face, etc., to prevent him from sleeping. Strong coffee is said to counteract the effect of some of these poisons.

**Poisoning by Dogwood, Ivy, etc.** — Bathe in salt and warm water, and afterwards apply a strong tea or decoction of witchhazel bark (Pond's Extract) When the feet and ankles are badly poisoned, as will sometimes be the case with farmers in working in the hay field, we have known great relief to follow covering them entirely for a few hours with freshly-turned soil, the soil seeming to counteract the effect of the poison in a remarkable degree.

**Convulsions.** — If a child is taken with convulsions, put it instantly into a hot bath (88° to 110° Fah.) to relax the muscles. Be very careful that the water is not too hot. Apply cold water compresses to the head. In fits, loosen all clothing, rub the body and limbs, and give the patient plenty of fresh air.

**When Bitten by a Dog.** — The first thing to do is to get rid of the poison before it passes into the system. This must be done by burning it out, or by a friend sucking it out, and immediately rejecting the blood taken into the mouth.

**Sunstroke.** — When a person is attacked with sunstroke, he must be carried into a cool place, and the temperature of the body reduced. This can best be done by undressing him. dashing cold water over him, and applying ice. Sunstroke may be often prevented by abstaining from the excessive use of cold water, wearing loose, light-fitting garments, and paying particular attention not to expose the head to the rays of the sun. If symptoms appear, drop every occupation and retire to the shade.

**Articles of Diet for the Sick.** — The following recipes for common articles of diet for sick persons, derived from various sources, may be sometimes convenient for reference in the household:

**Oatmeal or Indian Meal Gruel.** — Mix one or two tablespoonfuls of the meal smoothly in cold water; then stir it in one pint of boiling water, salted with a saltspoon of salt; boil slowly from one to two hours; sweeten afterward, if desired, to suit the taste.

**Barley Gruel.** — Wash the barley, then put half a teacup in a quart of cold water, let it boil two or three hours. Strain, sweeten to the taste, and flavor with a little grated nutmeg. (Gruels require very thorough cooking.)

**Thickened Milk.** — Dissolve two tablespoons of flour in a teacup of cold water. Boil one quart of milk in a can within another vessel of water; add the flour and water while the milk is boiling. stir all the while. and boil about ten minutes. Remove it from the fire, flavor with a teaspoon of the essence of lemon or vanilla. Sweeten to the taste.

**Panada.**—Put two or three soda crackers in a quart bowl; pour boiling water on each cracker slowly until it is swelled out, sprinkle a little sugar over the crackers, and add a cup of boiling water with a tablespoon of wine in it, if the patient requires it. Grate a little nutmeg on the top.

**Wine Whey.**—Boil half a pint of fresh milk in a porcelain saucepan. The moment the milk rises pour in a small wine-glass of sherry. Let it boil up again, and set the saucepan over on one side of the fire till the curd forms a lump. Do not stir it; the whey will separate from the curd.

**Arrowroot.**—Two teaspoons of arrowroot will thicken half a pint of milk or water. Dissolve the arrowroot in half a teacup of cold water, and add it by degrees to the half pint of boiling milk or water, stirring over the fire all the while. Boil about five minutes; flavor with essence of vanilla, or wine, and sweeten to the taste; grate a little nutmeg over the top.

**Corn-starch or Farina** may be used in the same way.

**Toast Water** is to be used when water is injurious; it satisfies thirst. Toast two slices of bread very brown; do not burn the bread; pour one quart of boiling water over the toast in a pitcher. Let it stand until cool before using.

**Cocoa Nibs or Shells.**—One quart of boiling water; two ounces of cocoa nibs or shells; one quart of fresh milk; wet the shells or nibs with a teacup of cold water; add the quart of boiling water; when boiling add two tablespoons of white sugar; boil an hour and a half; strain; add the milk which has been heated, and take from the fire. This is excellent for nursing mothers and invalids.

**Beef Tea.**—Chop fine one pound of beef freed from fat. Cover it with cold water, and let it stand one hour, put it in a large-mouthed bottle, and place the bottle in a pot of cold water, let it boil slowly for two hours, until the juice is all extracted from the meat; season with a little salt.

**Beef-juice and Wine** (for very weak patients).—Take the tenderloin of a beefsteak, and warm it before the fire on a wire gridiron, cut it to pieces, and express the juice with a lemon squeezer; put the juice in a wineglass of good wine. Give a teaspoonful at a time.

**Chicken Broth.**—A chicken weighing two pounds will make a quart of broth. Cut the chicken to pieces and break all the bones; pour on a quart of cold water, let it simmer from half to three-quarters of an hour, or until the meat is separated from the bones; strain it and put in a tablespoon of barley which has been cooked in a little warm water, add a pinch of salt. Some like half a cup of wine added: in this case return it to the fire and let it simmer five minutes longer, taking care that it does not burn.

**Lamb and Mutton Broth** can be made in the same way.

**Chicken Jelly.**—Take one chicken, and after having washed it thoroughly in cold water, cut the chicken to pieces and pound it until all the bones are broken, then place the chicken in a saucepan with enough water to cover it—about a quart. Heat it slowly in a covered vessel, and let it simmer slowly until the meat is in white shreds and the liquor is reduced to one-half. Strain and press, first through a colander and then through a coarse cloth, salt it to the taste, and return it to the fire: let it come to a boil and simmer five minutes, skim when cool; pour into a jelly mold, and it is ready for use. Keep it on the ice.

**Wine Jelly.**—Half a box of Cox's gelatine, pour on this quantity half a pint of cold water; let it stand one hour; then add one pint of boiling water, and half a pint of wine, and one teacup of powdered sugar. Strain through muslin, and pour it into molds that have been wet with hot water.

**Lemon Jelly** is made in the same way, only use the juice and rind of two lemons instead of the wine. Grate the lemon, and allow the rind to soak in a cup of hot water for half an hour.

**Rice Jelly.**—Half a cup of whole rice washed and soaked two hours in warm water. Add three pints of cold water, and cook the rice to a smooth paste, and the water is reduced to two pints. Strain it through barred crinoline, and season it with a little salt, and sweeten to the taste with granulated sugar. This is excellent for children with bowel complaint.

**Barley Water** (for sick children).—Two tablespoons of pearl barley cleansed, two cups of boiling water, one pinch of salt, and two teaspoons of white sugar; soak the barley half

an hour in a teacup of warm water, stir it without draining into the boiling water. Let it simmer for an hour, stirring often. Strain it before adding the sugar.

**Stewed Oysters** (for one person).—Open and drain the liquor from six oysters; mix a tablespoon of hot water with the juice, add a little salt and pepper; boil five minutes; skim off the froth, put in the oysters, let them boil *five* minutes, *not more;* add a teaspoon of butter; the moment it is melted remove from the fire and add a half cup of milk which has been boiled when the oysters were stewing.

**Clam Broth** (for one person).—Drain off a cup of juice from the clams, add half a teacup of hot water, season with a little salt and pepper; let it boil five minutes, skim, throw in the clams, let them stew fifteen minutes, take them out and add a soda cracker which has been rolled into a powder.

**Hoarseness.**—The best remedy for hoarseness with which we are familiar, and also to relieve a cough caused by an irritation in the throat, is to take a frequent dose of the following simple remedy: Add to good sharp cider vinegar a sufficient quantity of loaf sugar to make it, when dissolved, of the consistency of thin syrup; then sift in enough cayenne pepper to make it leave a burning sensation in the throat when used; take a small swallow to moisten the throat occasionally. Lemon juice may be used in place of vinegar.

**Sore Throat.**—Gargling with salt and water, camphor and water, or with a solution of chlorate of potash, is excellent for a sore throat. When the throat is swollen and much inflamed a mustard poultice or a poultice of part mustard and part ginger should be applied externally.

**Wonderful Liniment.**—Two ounces of oil of spike, 2 of organum, 2 of hemlock, 2 of wormwood, 4 of sweet oil, 2 of spts. ammonia, 2 of gum camphor, 2 of spts. turpentine, and one quart of pure cider brandy; mix well together and bottle tight.

This liniment is excellent for sprains, bruises, lameness, etc., etc., in horses. Omit the turpentine and you have one of the best liniments ever made for human ails, such as rheumatism, sprains, etc., whenever an outward application is required.

**Opodeldoc.**—Take alcohol half a gallon, 2 pounds of castile soap, 4 oz. of gum camphor, 2 oz. of oil of ambre, place the alcohol into a pot in hot water, shave up the soap and keep it hot until all dissolves, and you have the old original opodeldoc.

**Staining Wood.**—To stain wood brown, use a concentrated solution of potassium permanganate in water. Red—boil ¼ lb. of logwood and ½ oz. of soda in a pint of water; apply hot, and then go over the work with a strong aqueous solution of alum. Rose—potassium iodide in 12 parts of water for first bath; as second, mercuric chloride (corrosive sublimate) in 40 parts of water. Indigo solutions give blue washes. Wood dipped in concentrated hot solution of copper sulphate, and then in solution of washing soda, becomes light blue. Verdigris dissolved in 4 parts of vinegar imparts a good green color to dry wood. Turmeric dissolved in wood naphtha produces a yellow wash. Aqua regia (nitro-muriatic acid), when diluted with 3 parts of water, though somewhat destructive, is often used on light woods for a strong yellow.

For ebonizing wood. Brazil wood, powdered nutgalls and alum are boiled in water until a blackish color is obtained; the liquid is filtered and applied to the wood, which is then washed in a liquor made by digesting strong vinegar and a little oil of vitriol for some time with excess of iron turnings; thoroughly wash the wood, dry, and oil.

For staining fine woods of a rich, dark color, the following is applicable: Four ounces of gallnuts, 1 ounce of powdered logwood, ½ ounce of green vitriol, and ½ ounce of verdigris are boiled with water, and the solution, filtered hot, is applied to the wood, which is then coated with a solution of 1 ounce of fine iron filings, dissolved by digestion in a small quantity of hot wine vinegar.

Some of the finest effects are now produced in the toning or darkening of woods for decorative purposes—logwood, lime, brown soft soap, dyed oil, sulphate of iron, nitrate of silver exposed to sun's rays, carbonate of soda, bichromate and permanganate of potash, and other alkaline preparations being employed to this end. The art is simple. The solution is applied by dissolving one ounce of the alkali in two gills of boiling water, diluted to the required tone; the surface is saturated with a sponge or flannel, and immediately dried with soft rags. The carbonate is used for dark woods; oil tinged with rose madder may be applied to hard woods like birch, and a red oil is prepared from soaked alkanet root in linseed oil; the grain of yellow pine is brought out by two or three coats of japan much diluted

with turpentine and afterwards oiled and rubbed. To give mahogany the appearance of age, lime water, used before oiling, is effective. In staining woods the best and most transparent appearance is obtained by repeated light coats of the same; for oak stains a strong solution of oxalic acid is employed, and dilute nitrous acid for mahogany.

**Periods of Gestation of Domestic Animals.**—The minimum and maximum periods of gestation in domestic animals are as follows:

| | *Days.* | | *Average.* | | *Days.* | | *Average.* |
|---|---|---|---|---|---|---|---|
| In the mare, | 300 to | 400 | 340 | In the dog, | 55 to | 70 | 63 |
| " " cow, | 220 | 320 | 280 | " " cat, | 50 | 64 | 55 |
| " " sheep and goat, | 143 | 156 | 150 | " " rabbit, | 28 | 30 | 30 |
| " " pig, | 104 | 127 | 120 | | | | |

**How Long Animals Live.**—The average age of cats is fifteen years; of squirrels and hares seven to eight years; rabbits seven; a bear rarely exceeds twenty years; a dog lives twenty years, a wolf twenty, a fox fourteen to sixteen; lions are long-lived, the one known by the name of Pompey living to the age of seventy. Elephants have been known to live to the great age of four hundred years. When Alexander the Great had conquered Porus, King of India, he took a large elephant which had fought valiantly for the king and named him Ajax, dedicating him to the sun, and letting him go with this inscription, "Alexander, son of Jupiter, dedicated Ajax to the sun." The elephant was found with the inscription 340 years after. Pigs have been known to live to the age of twenty, and the rhinoceros to twenty-nine; a horse has been known to live to the age of sixty-two, but averages twenty-five to thirty; camels sometimes live to the age of one hundred; stags are very long-livers; sheep seldom exceed the age of ten; cows live about fifteen years. Cuvier considers it probable that whales sometimes live to one thousand years. The dolphin and porpoise attain the age of thirty; an eagle died at Vienna at the age of 104; ravens frequently reach the age of 100; swans have been known to live 300 years. Pelicans are long-lived. A tortoise has been known to live to the age of 107 years.

## Useful Tables for the Farmer and Gardener.—Estimate of Seeds for an Acre.

| | *Pounds.* | | *Quarts.* |
|---|---|---|---|
| Beets and Mangel Wurzel, | 4 to 6 | Mustard, broadcast, | 12 |
| Cabbage, | 1 to 1½ | Sorghum, or Chinese Sugar Cane, | 2 to 3 |
| Carrot, | 2 to 3 | | *Bushels.* |
| Cucumber in hills, | 1 to 2 | Beans, bush in drills, 2½ feet apart, | 1½ |
| Clover, red, broadcast alone, | 15 to 20 | Corn for fodder, | ⅛ to ½ |
| Clover, sown on grain in Spring, mixed with ½ bushel Timothy and 1 bushel Red Top, | 10 | Barley, broadcast, | 2 to 3 |
| | | Barley, in drills, | 1¾ to 2 |
| | | Buckwheat, | 1 to 1½ |
| Clover, white, broadcast alone, | 10 to 15 | Hungarian Grass, | ½ |
| Clover, white, in drills, | 8 | Kentucky Blue Grass, | 2 to 3 |
| Lucerne, broadcast, | 15 | Lawn Grass, | 2 to 3 |
| Onion, in drills, | 5 | Millet, broadcast, | ½ to ¾ |
| Parsnip, in drills, | 4 to 6 | Oats, | 2 to 3 |
| Radish, in drills, | 5 to 8 | Orchard Grass, | 2 to 3 |
| Radish, broadcast, | 12 to 16 | Pease, early, in drills, | 2 to 3 |
| Salsify, in drills, | 6 to 8 | Pease, Marrowfat, | 1½ to 2 |
| Spurry, broadcast, | 26 | Potatoes, in drills or hills, cut tubers, | 10 |
| Spinach, | 8 to 10 | Potatoes, cut to single eyes, | 3 to 5 |
| Tomato, | 1 oz. to 5,000 plants. | Rye, broadcast, | 1½ to 2 |
| Tobacco, | 1 oz. to 10,000 " | Red Top, | 2 to 3 |
| Turnip and Ruta Baga, broadcast, | 1½ | Rye Grass | 2 |
| Turnip and Ruta Baga, in drills, | 2 | Rhode Island Bent, | 2 to 3 |
| | *Quarts.* | Sainfoin, | 2 to 3 |
| Beans, pole, in hills 3½ x 4, | 8 to 12 | Timothy, | ½ |
| Corn, in hills, | 8 to 12 | Vetches, | 2 to 3 |
| Broom Corn, in hills, | 10 to 12 | Wheat, broadcast, | 1½ to 2 |
| Millet for seed, | 12 | Wheat, in drills, | ¾ to 1 |

**To Measure Corn in Cob.**—Two heaping bushels of corn on the cob will make one struck bushel of shelled corn. Some claim that one and one-half bushels of ear will make one bushel of shelled corn. Much will depend on the kind of corn, shape of the ear, size of the cob, etc.

**In Crib.**—To measure corn in a crib, multiply the length of the crib in inches by the width in inches, and that by the height of the corn in the crib in inches, and divide the product by 2,748, and the quotient will be the number of heaped bushels of ears. If the

crib flares at the sides, measure the width at the top and also at the bottom, add the two sums together, and divide the two, which will give the mean width.

**A Firkin of Butter** was formerly 56 lbs., but it is now generally put up in 50 or 100 lb. firkins.

**A Bale of Cotton** is 400 lbs, but it is put up in different States varying from 280 to to 720 lbs. Sea Island cotton is put up in sacks of 300 lbs.

**Measurement of Hay.**—The only exact method of measuring hay is to weigh it, but the rules given below will be found sufficient for ordinary practical purposes.

**To Find the Number of Tons of Meadow Hay in Windrows.**—Multiply together the length, in yards, and divide the product by 25. The quotient will be the number of tons in the windrow.

**To Find the Number of Tons of Hay in a Mow.**—Multiply together the length, height, and width, in yards, and divide by fifteen, if the hay be well packed. If the mow be shallow, and the hay recently placed therein, divide by 18, and by any number from 15 to 18, according as the hay is well packed.

**To Find the Number of Tons of Hay in Square or Long Stacks.**—Multiply the length of the base in yards by the width in yards, and that by half the height in yards, and divide by 15.

**To Find the Number of Tons of Hay in a Load.**—Multiply together the length, width, and height, and divide the product by 20. To ascertain the value of a given number of lbs. of hay, straw, or other commodity sold by the ton, at a given price per ton, multiply the number of lbs. by one-half the price per ton, and point off three figures from the right. The result will be the price of the article.

**To Measure Stone and Brick Walls.**—A perch of stone is 24.75 cubic feet. When built in the wall, $2\frac{3}{4}$ cubic feet are allowed for the mortar and filling; hence. 22 cubic feet of stone make one perch of wall. Masons estimate 3 pecks of lime and 4 bushels of sand to a perch of wall. To find the number of perches of stone in a wall, multiply together the length, height, and thickness in feet, and divide by 22. Common bricks are $7\frac{3}{4}$ to 8 inches long by $4\frac{1}{4}$ wide and $2\frac{1}{2}$ thick. Front bricks are $\frac{1}{4}$ inch longer and wider. It requires 20 common bricks to lay one cubic foot. In an 8-inch wall 15 common bricks make one foot of wall. To find the number of bricks in a wall 12 inches or more in thickness, multiply together the length, height, and thickness in feet, and that again by 20. For an 8-inch wall, multiply the length by the height, and that by 15, and the product will be the number of bricks in the wall. If the wall is perforated by openings, such as doors, windows, etc., multiply the length of such openings by the width, and that by the thickness, and deduct from the cubic contents of the wall before multiplying by 15 or 20 as above.

**To Measure Land.**—If the field be a square or parallelogram, multiply the length in rods by the width in rods, and divide by 160, the number of square rods in an acre. If the field is triangular, multiply the length of the longest side in rods by the greatest width in rods, and divide half the product by 160. If the field be of irregular shape, divide it into triangles, and find the acreage of each triangle as above. All straight-sided fields can be thus measured. Where the sides are crooked and irregular, take the length in rods in a number of places at equal distances apart, add them, and divide by the number of measurements, which will give the mean length; proceed similarly with the width, multiply the mean length by the mean width, and divide by 160. Where the field is in a circle, find the diameter in rods, multiply the square of the diameter by 7,854, and divide by 160.

**To Lay out an Acre in Rectangular Form.**—An acre of land contains 160 square rods, or 43,560 square feet. Hence, to lay out an acre at right angles (square corners), when one side is known, divide the units in the square content by the units of the same kind in the length of the known side. Thus: if the known side be 4 rods, divide 160 by 4, and the quotient 40 will be the depth of the acre-plot. If the length of the known side be 90 feet, divide 43,560 by 90. and the quotient 48 will be the depth of an acre-plot.

**Measurement of Wood and Lumber.**—A cord of wood contains 128 cubic feet. To ascertain how many cords there are in a pile of wood, multiply the length by the height, and that by the width, and divide the product by 128. To ascertain the circumferences of a

tree required to hew a stick or timber of any given number of inches square, divide the given side of the square by .225, and the quotient is the circumference required. Round timber, when squared, loses one-fifth. To measure round timber take the girth in inches at both the large and small ends, add them, and divide by 2, which gives the mean girth; then multiply the length in feet by the square of one-fourth of the mean girth, and the quotient will be the contents in cubic feet. This rule is commonly adopted, and gives four-fifths of the true contents, one-fifth being allowed to the purchaser for waste in sawing.

**To Measure Inch Boards.**—Multiply the length in feet by the width in inches, and divide the product by 12. The quotient will be the contents in feet. For lumber $1\frac{1}{4}$ inches thick, add $\frac{1}{4}$ to the quotient. If $1\frac{1}{2}$ inches thick, add $\frac{1}{2}$. If $1\frac{3}{4}$ inches thick, add $\frac{3}{4}$. If 2 inches thick, divide by 6 instead of by 12. If $2\frac{1}{4}$ inches thick, add $\frac{1}{4}$ to the quotient, and so on. If 3 inches thick, divide by 4. If 4 inches thick, divide by 3. If 6 inches thick, divide by 2. To ascertain the contents (broad measure) of timber, multiply the width in inches by the thickness in inches, and that by the length in feet, and divide the product by 12. The result will be the number of feet. To ascertain how many feet of lumber can be sawed from a log, from the diameter of the log in inches substract 4; one-fourth the remainder squared and multiplied by the length of the log in feet will give the correct amount of lumber that can be sawed from the log.

MEASURES OF AN ACRE PLOT.

Either of the following measures include about an acre plot:

| | |
|---|---|
| 3 by 53 1-8 rods. | 8 by 20 rods. |
| 4 by 40 " | 9 by 17 7-8 " |
| 5 by 32 " | 10 by 16 " |
| 6 by 26 2-3 " | 11 by 14 6-11 " |
| 7 by 22 6-7 " | 12 by 13 1-3 " |

12 rods 10 feet and $8\frac{1}{2}$ inches square make an acre.

**To Measure Grain in Bins.**—Multiply the length of the bin in inches by the width in inches, and that by the height in inches, and divide by 2150 for struck bushels, and by 2748 for heaped bushels. The quotient will be the number of bushels contained in the bin.

**To Compute the Weight of Cattle.**—Multiply the girth in inches, immediately back of the shoulders, by the length in inches from the square of the buttock to the point of the shoulder blade, and divide the product by 144, which will give the number of superficial feet. If the animal has a girth of from 3 to 5 feet, multiply the number of superficial feet by 16, which will give the weight of the animal. If the girth is from 5 to 7 feet, multiply by 23, and if from 7 to 9 feet, multiply by 31. If less than 3 feet girth, as in the case of small calves, hogs, sheep, etc., multiply by 11. Of course many circumstances, such as the build of the animal, mode of fattening, condition, breed, etc., will influence the weight, but the above will be found approximately correct.

**Weight of a Bushel of Produce.**—The number of pounds in a bushel of the various articles of produce varies somewhat in the different States. The majority, however, have adopted the following:

| | lbs. | | lbs. |
|---|---|---|---|
| Apples (dried), | 28 | Indian corn, | 56 |
| Barley, | 43 | " " (in ear), | 68 |
| Buckwheat, | 42 | " " (meal), | 50 |
| Beans, | 60 | Oats, | 32 |
| Beans (castor), | 46 | Onions, | 57 |
| Coal (mineral), | 80 | Peaches (dried), | 28 |
| Charcoal (hard wood), | 30 | Pease, | 60 |
| Flax seed, | 56 | Potatoes, | 60 |
| Grass seed (blue), | 14 | Rye, | 56 |
| Grass seed (clover), | 60 | Rye (meal), | 50 |
| Grass seed (timothy), | 45 | Salt, | 50 |
| Hemp seed, | 44 | Wheat, | 60 |

**Rules for Computing Interest, giving Convenient Formula, Rules, and Tables for Computing Interest.**—The *rate per cent.* differs in some States from that of others. For complete list of such rates per cent., compiled from authorized sources, see page 930.

CONVENIENT FORMULAS.

Principal + rate % = interest for one year.
Principal + rate % + time, (in years and decimals of a year) = interest for such time.

### To Compute Interest when Partial Payments have been made.

United States Rule.—I. *Find the interest and amount of the principal to the time of the first payment: if the payment is greater than the interest, subtract the payment from the amount, and treat the remainder as a new principal.* II. *If the payment is less than the interest, find the amount of the note to the time when the sum of the payments shall exceed the interest due; subtract the sum of the payments from the amount, and proceed as before.*

This rule was founded upon the decision of Chancellor Kent. The principle is that neither interest nor payment shall draw interest. It has been adopted by nearly all the States—New Hampshire, Vermont, and Connecticut being the principal exceptions. In Connecticut, the Supreme Court has adopted the following principles in the calculation of interest:

I. *Payments made when interest has run a year or more, and those less than the interest are treated as in the U. S. rule.* II. *A payment made within a year from the beginning of any interest draws interest for the rest of that year, if that year does not extend beyond settlement; and its amount must be taken from the amount of the principal for that year. But if the year does extend beyond settlement, the amounts are computed for both principal and payment, to settlement. The difference of these amounts is the balance due.*

In some States, as in Vermont and New Hampshire, what is called *annual interest* is allowed; that is, if *interest* is not paid when due, it will bear *simple interest.*

Commercial or Merchants' Rule.—*Find the amount of the principal at the time of settlement. Then find the amount of each payment from the time it was made until settlement, and subtract the sum of the amounts of the payments from the amount of the principal.*

### TIME REQUIRED FOR DIGESTING FOOD.

| Food. | How Cooked. | H. M. | Food. | How Cooked. | H. M. |
|---|---|---|---|---|---|
| Apples, sour, mellow | Raw | 2.00 | Milk | Boiled | 2.00 |
| Apples, sour, hard | Raw | 2.50 | Milk | Raw | 2.15 |
| Apples, sweet, mellow | Raw | 1 30 | Mutton, fresh | Broiled | 3.00 |
| Bass, striped | Broiled | 3.00 | Mutton, fresh | Boiled | 3.00 |
| Beans, pod | Boiled | 2.30 | Mutton, fresh | Roasted | 3.15 |
| Beans and green corn | Boiled | 3.45 | Oysters, fresh | Raw | 2.55 |
| Beef | Fried | 4 00 | Oysters, fresh | Roasted | 3.15 |
| Beefsteak | Broiled | 3.00 | Oysters, fresh | Stewed | 3.30 |
| Beef, fresh, lean, dry | Roasted | 3.30 | Parsnips | Boiled | 2.30 |
| Beef, fresh, lean, rare | Roasted | 3.00 | Pig, sucking | Roasted | 2.30 |
| Beets | Boiled | 3.45 | Pigs' feet, soused | Boiled | 1.00 |
| Brains, animal | Boiled | 3.45 | Pork steak | Broiled | 3.15 |
| Bread, corn | Baked | 3.15 | Pork, fat and lean | Roasted | 5.15 |
| Bread, wheat, fresh | Baked | 1.30 | Pork, recently salted | Stewed | 3.00 |
| Cabbage | Raw | 2.30 | Pork, recently salted | Broiled | 3.15 |
| Cabbage, with vinegar | Raw | 2.00 | Pork, recently salted | Fried | 4.15 |
| Cabbage | Boiled | 4.30 | Pork, recently salted | Boiled | 4.30 |
| Carrot, orange | Boiled | 3.13 | Potatoes, Irish | Roasted | 2.30 |
| Catfish | Fried | 3.30 | Potatoes, Irish | Baked | 2.30 |
| Cheese, old, strong | Raw | 3 30 | Potatoes, Irish | Boiled | 3.30 |
| Chicken, full grown | Fricasseed | 2.45 | Salmon, salted | Boiled | 4.00 |
| Codfish, cured dry | Boiled | 2.00 | Sausages, fresh | Broiled | 3.20 |
| Custard | Baked | 2.45 | Soup, barley | Boiled | 1.30 |
| Duck, tame | Roasted | 4.00 | Soup, bean | Boiled | 3.00 |
| Duck, wild | Roasted | 4 30 | Soup, chicken | Boiled | 3.00 |
| Eggs, fresh | Raw | 2.00 | Soup, mutton | Boiled | 3.30 |
| Eggs, fresh | Whipped | 1.30 | Soup, oyster | Boiled | 3.00 |
| Eggs, fresh | Roasted | 2.15 | Soup, beef, vegetables | Boiled | 4.00 |
| Eggs, fresh | Soft boiled | 3.00 | Soup, marrow bones | Boiled | 4.15 |
| Eggs, fresh | Hard boiled | 3.30 | Tripe, soused | Boiled | 1.00 |
| Eggs, fresh | Fried | 3.30 | Trout, salmon, fresh | Boiled | 1.30 |
| Fowls, domestic | Roasted | 4.00 | Trout, salmon, fresh | Fried | 1.30 |
| Fowls, domestic | Boiled | 4.00 | Turkey, wild | Roasted | 2.18 |
| Gelatine | Boiled | 2.30 | Turkey, domesticated | Roasted | 2.30 |
| Goose, wild | Roasted | 2.30 | Turkey, domesticated | Boiled | 2.25 |
| Hashed meat and vegetables | Warmed | 2.30 | Turnips | Boiled | 3.30 |
| Heart, animal | Fried | 4.00 | Veal, fresh | Boiled | 4.00 |
| Lamb, fresh | Broiled | 2.30 | Veal, fresh | Fried | 4.30 |
| Liver, beeve's, fresh | Broiled | 2.00 | Venison steak | Broiled | 1.35 |

# APPENDIX.

By MANLY MILES, M.D., D.V.S., F.R.M.S.

**PROGRESS OF THE INDUSTRIES.** — While the principles that underlie all consistent systems of practice remain constant, a revision and readjustment of practical details must constantly be made to keep abreast of the rapid progress that is now being made in all industrial pursuits. The rapid succession of mechanical inventions and the remarkable discoveries in science during the past half century are unprecedented in the world's history, and, under the stress of the changed conditions that have been developed, improved processes and methods in all of the productive arts are rapidly replacing the routine systems that formerly prevailed. Within the past five years this progress of discovery and invention has been intensified, and in the future there must be still further adaptations of industrial methods to the changed conditions of production.

In discussing the ways and means of agricultural progress and improvement, the latest discoveries in the wide range of natural sciences must receive attention, but the full benefits that may be derived from their application can only be made available by taking into account the causes which have brought about the present prevailing conditions of production, and adjusting our methods of practice to conform to them. This is emphatically an age of industrial activity that is characterized by intense competition in every department of business, and a review of some of the leading facts in the recent progress of the industries will aid us in understanding the problems the farmer is most interested in solving, and serve to indicate the lines that may be successfully followed in adapting his practice to the changed conditions which now surround him.

One of the first effects of competition is to cheapen production and diminish the percentage of profits, and this has been carried on to so great an extent in manufactures of all kinds, that the small establishments have been crowded out, and large investments of capital are required to conduct the business on an extensive scale, so that an accumulation of the small items of profit may be an object worth seeking. The trades and handicrafts that formerly required an apprenticeship of several years for their mastery are now nearly obsolete, and machinery, with unskilled labor, is not only taking the place of the skilled artisan, but it is doing the world's work with an efficiency and economy of labor and materials that could not be realized under former methods of production.

The subdivision of labor and the use of machinery, that is especially adapted to a particular purpose, has been made essential in almost every process of profitable production, and executive ability and a knowledge of business methods are of far greater importance in directing and combining the many details under a consistent and efficient system than the technical skill of the trained artisan.

Machinery and implements of all kinds, articles of food and clothing of every description, and the many convenient appliances that administer to our comfort and enjoyment, are all manufactured on an extensive scale and brought to our doors at a price very much below what they could have been made for by the most skillful and expert artisans, under the old methods of their respective trades. In almost all of the handicrafts or trades, as they are

usually called, the workman can only find employment in the repair of articles that have originally been made under an intensive and specialized system of manufacture with which they cannot successfully compete.

As competition increases the tendency is to larger combinations of capital and more extensive plants of machinery to secure greater economy in production in every direction, and this must be looked upon as the inevitable result of the progress of the age. The "struggle for existence," which is recognized as a prominent factor in the evolution of the life of the globe, is equally apparent in the strife of the industrial world. The "survival of the fittest" under the conditions of the environment is the law of all industrial enterprises, and when every available element is not made to contribute to the general result the outcome is financial failure. There are of course evils arising from this unavoidable tendency to concentration and combination that are the natural outgrowth of prevailing conditions, which we need not stop to consider. We must recognize them, however, as but incidents in the progress of civilization that have their compensations in many directions, in which the welfare of all classes is concerned.

In many of the productive industries the margin of profits, under the best management, is so small that attention must be directed to the utilization of the waste products of manufacture, and this, in many cases, has been accomplished by the aid of science, so that the residues have become the leading object on the score of profit, and the original products of the industry are considered as of secondary interest.

The importance of the residues that may be utilized, and their influence on the industry, may be illustrated by the latest improvements in the manufacture of illuminating gas. From the residues of this industry many important commercial products are obtained. The annual value of the by-products of the gas-works of Great Britain have been estimated as follows:

| | |
|---|---|
| Coloring matters, | $16,214,000.00 |
| Sulphate of ammonia, | 9,423,000.00 |
| Pitch (325,000 tons), | 1,766,600.00 |
| Creosote (25,000,000 gals.), | 1,006,720.00 |
| Crude carbolic acid (1,000,000 gals.), | 484,000.00 |
| Gas coke, 4,000,000 tons, after allowing 2,000,000 tons consumption in working the retorts, | 11,616,000.00 |
| | $40,510,320.00 |

The coal used is estimated at 9,000,000 tons, costing $26,136,000, so that the by-products of the gas-works exceed the original value of the coal used by the sum of $14,000,000. This, of course, has a marked influence on the cost of gas and the price at which it can be furnished to the consumer.

A difference in the cost of production of but a small fraction of a cent determines the balance of profit or loss in many of the industries, and the results obtained are the product of many apparent trifles in the economy of labor and raw materials, including the complete utilization of every residue. In this connection it should be noted that one of the most striking characteristics of the age is to emphasize the importance of quantities, or differences, so minute that we are hardly able to comprehend them when stated in mere figures. In every department of exact knowledge, as well as in the industries, minute and apparently insignificant quantities are found to be of the first importance.

With the advance of science the most delicate means of measurement are required in investigation. The one-thousandth of a grain is now of greater significance than many grains with the ruder instruments of a not remote past. Professor Langley's bolometer records less than $\frac{1}{100,000}$ of a centigrade degree of temperature, and the results obtained with it are of the greatest importance in the domain of molecular physics.

The tendency is in the same direction in the general progress of the industries, and we find that an accumulation of slight advantages, that would have been looked upon as inconsiderable trifles but a few years ago, are the prime factors that determine success under present conditions of production.

The greatest triumphs of engineering skill have been made possible by improvements in making steel which involve the control of changes so slight that they would naturally be looked upon as hardly worth notice. In the Bessemer process of making steel it is necessary to stop the blast at a certain definite stage, and if it is "stopped a few seconds too soon, or carried for a few seconds too long a time, the quality of the resulting steel suffers." The spectroscope is now used to determine this point with accuracy "by the disappearance of certain absorption-bands observed in the spectrum of the flame," and steel of uniform definite quality can now be produced for different purposes. The Forth bridge, one and one-half miles long, with two spans of seventeen hundred feet each; the Eiffel tower, one thousand feet high; the armor of the iron-clad, with its steel face; and the projectile to pierce this steel face, "all equally depend upon the 'truth' of steel as much as does the barely visible hair-spring of the chronometer which enables the longitude of the ship in which it is carried to be ascertained. Now what makes the difference between trustworthy and untrustworthy steel for each particular purpose? Something which, until our better sense comes to our aid, we are inclined to look upon as ridiculously insignificant — a 'next-to-nothing,'— the question whether there shall be added or deducted one-tenth of one per cent. of carbon is a matter of great importance in the resulting quality of the steel. The variation of this fraction of a percentage may render your boiler-steel untrustworthy; may make the difference between safety in a gun and danger in a gun; and may render your armor-piercing projectile unable to pierce even the thinnest wrought-iron armor."

Success in all industrial pursuits can only be secured by a mastery of the forces of nature, under the prescribed conditions of the environment, through the intelligent and consistent applications of exact knowledge. The small margin of profits in other industries, and the attention to minute details that are essential to success, are well worth the careful consideration of the farmer, as he is often misled by fanciful underestimates of the profits of farming when compared with other departments of business. At a recent farmers' institute financial statistics were presented of a particular farm, for a term of years, that were interpreted as showing that the present value of the farm, with its improvements, was much less than it had cost, and it was stated that if the original capital had been invested at a moderate interest for the same period a far better result would have been obtained. The fallacies of such statements are obvious and need not be discussed. In reply to this unfavorable showing of the farmer a neighbor made the remark that he had known the owner of this farm when he was not worth fifty dollars, and that he knew he now had a comfortable home, with thousands of dollars at his command, "which certainly proved that he was making a better success of farming than he was crediting himself with."

Farmers who undervalue their own calling by unfavorable comparisons with other business enterprises overlook the fact that the inevitable tendency of industrial activity, in all of its departments, under the present conditions of intense competition, is to destroy capital, diminish the percentage of profits, and make labor more efficient. This appears to be the law of industrial progress of universal application.

For the purpose of illustration let us trace the results of the opening of the Suez canal, in 1869, as pointed out by Hon. D. A. Wells. The voyage from England to Calcutta, that had formerly taken from six to eight months, was now shortened to one month. By the old route sail vessels could alone be used. With steam vessels 2,200 tons of coal were required to carry 800 tons of freight, and the saving in time was more than counterbalanced by the increased cost of transportation.

On the new route, by the canal, steam could be profitably used, and the sail vessels were no longer in demand, which involved an immense loss of capital. Improvements in the marine engine were soon afterwards made which had many advantages in the economy of fuel, and the available room for freight. This led to the construction of new vessels for the India trade in 1875–6, which superseded the old forms at another great sacrifice of capital. Since that time still greater improvements in the construction of steamships have been made, and these steamers, that have been in use but a few years, are replaced by better models for the purpose, and sold at a loss which involved an additional destruction of capital. The conditions of steam transportation are now decidedly changed from what they formerly were, and 800 tons of coal are now found sufficient for the transportation of 2,200 tons of freight. With the new fleet freight can be carried at a profit at rates that would have been ruinous with the old models, and the prospect now is that improvements in the construction of vessels for this trade, which have been suggested as the results of past experience, will soon lead to the adoption of new vessels of a better and more economical type.

The same destruction of machinery and consequent loss of capital, with diminished percentage of profits, has taken place in other industries, as in the manufacture of cotton and woolen goods, the refining of sugar, and many other departments of production. At a time when the New York market was overstocked with cotton goods, which were selling at less than the cost of manufacture, and many of the cotton factories were closed, I visited one of the large establishments, employing some three thousand operatives, which was running at its full capacity. The extensive scale on which the business was conducted under a thorough system of management, with the strictest economy and efficiency in the labor expended, which was made possible by the use of new and improved machinery, in many processes, working under the most favorable conditions, made the small profit of a fraction of a cent a yard a sufficient inducement to keep the factory running, while other less perfectly equipped establishments were obliged to suspend operations.

**Progress in Agriculture.** — Enough has been said to call attention to the general tendencies of the progress of the age, and we must make an application of these laws of industrial development and prosperity to the business of farming. As the conditions of progress and the elements of success are the same in all of the industries, it is evident that the same methods that have been found advantageous in other industrial pursuits must be applied in agriculture so far as they can be made available. Fortunately agriculture is exempt from some of the conditions that intensify competition in other productive arts. From the very nature of the case the subdivision of labor and specialization in production, that are essential to success in manufactures, cannot be applied in agriculture. The farm may be looked upon as a factory in which a great variety of interests must be carried on with a common purpose in view, and it is only in limited localities that special systems can profitably take the place of a diversified system of farming.

The low prices of farm products that now prevail, and are likely to continue in the future, are largely the result of the unprecedented facilities for transportation which bring the most remote localities in direct competition in the markets of the world. The obvious remedy for these low prices is the adoption of a thorough and consistent system of farm management, in which every available factor of production is recognized, and made use of, and the losses arising from the waste of productive elements and misapplied labor are carefully avoided.

The avoidable wastes of the farm, which have been discussed to some extent in the preceding pages of this work, are enormous, and few farmers appreciate their real magnitude and significance. From the best accessible data derived from the published farm statistics

for 1884, I have made careful estimates which show that the most important elements of fertility in the barnyard manure of the State of Michigan (or what should be utilized as such under a good system of management), valued at their market price in the form of commercial fertilizers, are worth at least $35,000,000 for the year named; and in the United States their aggregate value will reach the enormous sum of $1,092,950,000, which is more than twice the market value of all agricultural exports for the same year.

Under present conditions of management it will be safe to assnme that at least one-half of this valuable residue is lost through neglect, or ignorance of the proper methods of conserving and utilizing it. This annual loss to the farmers of the United States, which may readily be prevented, of a sum that exceeds the value of all farm products exported, I have repeatedly urged as a matter of the first importance in any consistent efforts to develop an improved system of farm practice. This waste of the essential element of production must be generally recognized and remedied as the first step in the progress of agriculture, or the full benefits of the many other means of improvement cannot be realized.

In the practice of agriculture the great variety of interests that are involved in the general system of management should be carefully adjusted and correlated, so that each will have its appropriate influence and contribute its full share to the aggregate of profits. The most formidable obstacles we have to contend with, in attempts to improve the principles and practice of agriculture, arise from partial and superficial views of the problems under consideration, and the undue prominence given to hasty generalizations, based on assumed data, that in themselves are of doubtful import.

The so-called nutritive or feeding ratios, that are now so frequently discussed as factors of paramount importance in the management of live stock, are based on chemical theories of nutrition that are not sufficient to account for the relations of food to the wants of the animal economy, and the principles of physiological science that are now generally accepted cannot be reconciled with the assumptions that are made in regard to them. Investigations which have been strictly confined to a single department of science must be checked and reconciled with the results obtained in parallel lines of research, before they can be accepted as safe guides in practice. The problems involved in the nutrition of plants and animals are exceedingly complex, from the marked interdependence of vital activities and processes, and in the present conditions of knowledge we cannot formulate them in terms that express the transformations of matter, and energy involved in them. Superficial views, based on a few detached observations that have not been correlated with well-established principles, cannot fail to mislead us and obscure the most important factors in the problems with which we are concerned. Dr. Hodgson well says, "If any kind of knowledge can do harm to any living being, it is just this superficial knowledge. It is like the twilight, which, holding of day on the one hand and of night on the other, mocks the senses with distorted appearances which thicker darkness would hide, but which broader daylight would dispel."

**Low Prices of Farm Products.** — The prospect of prevailing low prices in the farming of the future should not be regarded as a discouraging outlook. Farmers must recognize the changed conditions as an unavoidable outcome of the progress of the age, and regulate their practice accordingly. The depression in the prices of farm products should serve as an incentive to the exercise of greater intelligence and skill, and lead to the adoption of a consistent and well-planned system that provides for the proper adjustment of every detail of management, so that it may yield the best possible returns.

**Agricultural Education.** — There has never been a time in which the advantages of education in agriculture were so clearly apparent. Science in its several departments now offers to the farmer suggestions in regard to the details of farm economy of great practical

value, and the narrow margin of profits in all farm products admonishes him to make these aids to production a subject of earnest study. The direct and immediate applications of science should not, however, mislead us in regard to the real scope and aim of agricultural education, and the advantages to be derived from it.

Agriculture is the oldest art, and its practical principles, which have been established by experience, are not likely to be essentially changed by the direct applications of science. It is the mission of science to explain the details of practice and suggest lines of experiment that will aid in securing greater certainty and efficiency in the results. Notwithstanding the intimate relations of science to the practical problems in agriculture, a training in the exact methods of scientific investigation and reasoning is of far greater importance in the business of farming than any direct applications we are enabled to make of the principles of science. The ability to investigate and trace the relations of cause and effect in the problems presented in the every-day's experience of the farm, is of greater value than any specific routine prescription derived from the formulated data of any special department of science.

In the industrial strife in which agriculture is involved, in common with other productive arts, the intelligent applications of exact knowledge to every available aid to production can alone ensure success, and I know of no business or profession in which a wider range of knowledge can be profitably used, or that offers better inducements to the cultivated, trained student of science than the practice of agriculture now presents.

**Improved Farm Practice.**— From this outline of the tendencies and results of industrial progress we may form some general conclusions as to the leading principles that must characterize the farming of the future under the prescribed conditions. In the first place, it will be readily admitted that every available element of production should be made to contribute its full share to the aggregate of the small items of profit. In connection with this, a thorough system of farm management will be required to secure the strictest economy in every department and the efficient application of the necessary labor. Wastes of all kinds will be avoided, and, as far as practicable, all residues will be utilized as a means of direct profit, or as a resource of future production. This will, of course, involve the intelligent practice of a mixed husbandry, and the sales from the farm will be largely in the form of animal products.

The live stock of the farm will be looked upon as *machines* for converting the field crops into animal products of greater value, and the residues of this process, in the form of manure, will be carefully preserved and returned to the soil to maintain its fertility. The animal as a machine, employed in this farm factory, will be perfectly adapted to the special purpose in view, and provided (so to speak) with all the modern improvements that can add to its efficiency and economy in the work it has to perform. As in other industrial arts, the machine that does not give the best possible returns for the capital invested must give place to an improved form that works with greater economy and a less waste of raw material in the shape of food consumed. These closely related propositions appear to be self evident, and the only safe guides in an improved agriculture. The whole matter may be summed up in the single proposition, that the same business principles must be applied in the farming of the future that command success in the commercial world under the stress of intense competition.

**Metabolism of Soils.** — Soils are not a mass of inert definite compounds, as we might be led to infer from the prominence frequently given to the results of chemical analysis; on the contrary, they are in a state of active, incessant change, from the action of chemical, physical, and biological agencies. As it is difficult in a particular case to determine which one of these allied factors has the greatest influence in bringing about the changes

that are taking place, or whether they are all acting together and have interdependent relations, it will be convenient to use the term *metabolism* to express the sum of the changes without attempting to distinguish the chemical and physical from the biological activities.

When a sample of fertile soil is examined under the microscope, swarms of living organisms, of a variety of forms, will be seen, all of which are actively carrying on the vital processes of nutrition and reproduction at the expense of the materials which surround them. Some of the simplest of these organisms are exceedingly minute, appearing under a magnifying power of from 500 to 1,000 diameters, like the dots and dashes of the punctuation points of this page. What they lack in size is, however, fully compensated for by their immense numbers and their inconceivable powers of multiplication and reproduction. In a small fraction of a drop of liquid obtained from a rich garden soil countless numbers may be observed in active motion and apparently enjoying the vital activities with which they are endowed. From the latest investigations in biological science, there are good reasons for believing that these minute living forms are active and essential agents in the elaboration of plant food from the constituents of the soil.

As animals are dependent on plants for their supply of nutritive material, so plants, in their turn, are likewise dependent, to a great extent at least, on this lower plane of living beings to prepare suitable food for their purposes of nutrition. As with other forms of life, certain conditions of temperature, moisture, and food supply are essential to the life and well-being of these minute organisms. When the proper conditions are provided, these micro-organisms take the materials required in their processes of nutrition from the soil constituents in a state of solution and even from its solid particles, and thus aid in its disintegration. The inorganic soil constituents are converted into organic substances in the bodies of these organisms, and in their ultimate dissolution they contribute materially to the organic constituents of the soil. In taking their food supply from the liquid or solid constituents of the soil, they leave residues that are available for the nutrition of plants, which are of the greatest importance in promoting their vigorous growth and development.

From these well-established facts it will be seen that the biological conditions of soils, or their adaptation to the vigorous exercise of the vital activities of this world of microscopic forms, is quite as important as a means of liberating the elements of fertility and plant growth as the chemical composition, which was formerly looked upon as the prime factor of productiveness. The metabolism of soils furnishes a good illustration of the complexity of the problems of farm economy, and the dangers of devoting attention too exclusively to the purely chemical factors involved.

Of the various forms of micro-organisms concerned in the metabolism of soils, some have a specific function to perform, while others are undoubtedly concerned in bringing about a general process of disintegration that is quite as important in its ultimate results. Each species may be aided or kept in check by the activities of other species. The residues remaining after one species has taken what it wants from its favorite food are precisely what another species can best feed on, and for this reason we find an orderly succession of different species engaged in the work of disintegration going on in the soil. One species makes an attack on the root residues of the crops that have been harvested, and prepares the way for the action of other forms, and these in their turn are succeeded by others before the organic materials of the dead roots are reduced to a condition that makes them again available as plant food.*

*Many of the micro-organisms of the soil are properly called *microbes* or *bacteria*, and they are classified in accordance with peculiarities of form. The globular species are called *cocci*, and they represent several genera; the smaller ones are *micrococci*, and the larger ones *macrococci*; when grouped in pairs they are *diplococci*, and when in rows or chains they are *streptococci*. The short rod-like forms

**Nitrification.** — When investigating the influence of soils on the purification of sewage, in 1878, Schloesing and Müntz made the discovery that the nitrogenous materials of the sewage were changed to nitric acid by the action of an organized ferment, or microbe. What had formerly been considered as a process of direct oxidation was found to be the work of a living organism, and the conditions under which this process of nitrification was carried on were more fully investigated at Rothamsted by Warington, and on the continent by other experimenters, with results of great practical importance.

With other favorable conditions, the temperature has an important influence on the rapidity of the process. It is carried on slowly at the freezing point, and then rapidly increases as the temperature rises, until, according to Schloesing and Müntz, the maximum is reached at 99° F. "It almost ceases at 122°, and is entirely stopped at 131°." Warington, however, showed that under certain conditions a prolonged temperature of 104° was apparently fatal to the ferment.

At Rothamsted it was found that while thirty-seven days were required for nitrification, at a temperature of 52°, the same process was completed in eight days at a temperature of 86°. Schloesing and Müntz say that at 98.6° nitrification is ten times more rapid than at 57°.

An open porous soil that freely admits the air furnishes the most favorable conditions for rapid nitrification, and this fact enables us to explain some of the observed advantages of thorough drainage. The presence of some salifiable base, with which the nitric acid may combine, is essential to the process, and the addition of small quantities of lime, particularly in the form of gypsum, were found to be advantageous. The increase of the clover crop from small dressings of gypsum will be readily called to mind in this connection. The nitrates of the soil are increased by the application of nitrogenous manures, as the microbes are thus furnished with more abundant supplies of material on which their specific activities may be exercised. It may be added that "the production of nitrates in the soil is of the greatest importance to vegetation, nitrates being the form in which nitrogen is chiefly assimilated by plants. The abundance or poverty of nitrates in the soil thus determines, to a great extent, the quantity of crop which a field will produce. In a fertile soil the formation of nitrates is always in progress. It will take place most abundantly in the surface soil, as here the proportion of nitrogenous organic matter (the remains of previous vegetable and animal life) is most considerable, and the access of air most free."

From experiments to determine the distribution of nitrifying organisms in the soil at Rothamsted it was found that they were most abundant in the first nine inches of the surface soil, and gradually diminished in numbers to a depth of six feet, where they were rarely present. They were more numerous at the depth of two feet in land under fallow than at the same depth in land where crops were growing.

From my own experiments with the soil microbes of nitrification it appears that they may rapidly increase and give indications of vigorous activity without producing nitric acid where there is a deficient supply of lime or some other salifiable base, and when they had been cultivated for several generations under such conditions, the addition of a minute quantity of gypsum would lead at once to the production of nitric acid.

The struggle for existence is evident in the groups of microbes concerned in the metabolism of soils. When the conditions are not favorable for the activity of the nitrifying microbes, other forms prevail, some of which may produce nitrous acid, while others may be

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belong to the genus *bacterium*, and the longer straight or slightly curved rods are placed in the genus *bacillus*. The longer spirally curved rods belong to different genera, as *vibrio*, *spirillum*, and *spirochaete*. Several species of *infusoria* of a higher grade of organization than the *microbes* are abundant in rich soils under favorable conditions of temperature and moisture.

engaged in the reverse process of reducing the nitrates of the soil and changing their nitrogen into gaseous or other forms that are not available as plant food. To what extent or under what exact conditions this waste of nitrogen occurs has not been definitely determined. This fact is, however, of great practical interest, as it has a direct bearing on what we have repeatedly urged in regard to soil exhaustion. The crops removed from the land are not the sole, or even the principal, factors in producing soil exhaustion. When plant food is elaborated in the soil in the processes of metabolism, if it is not used by being converted into paying crops, it may be lost in the course of the subsequent changes to which it is subjected. The materials that constitute the food of plants cannot be retained in the soil, in an available form, for any extended period, as they are subjected to constant change, and, in the circle of transformations in which they are involved they may, for the time being, or even permanently, be placed beyond the reach of growing plants.

The evidence that microbes are important factors in soil metabolism seems to be conclusive, and it now appears that the problems relating to the source from which plants derive their supplies of nitrogen can only be solved by taking into the account the activities of the microbes of the soil.

The growth of certain leguminous plants, as for example, the clovers, seems to increase the nitrification of the soil, and it is probable that the microbes of nitrification find favorable conditions for the exercise of their activities in the vicinity of the clover roots, and some of the latest investigations appear to indicate that the microbes may appropriate the free nitrogen of the atmosphere under such conditions and render it up in an available form for the nutrition of the clover. In a recent letter Sir John Lawes writes me: "I think we have evidence to show that in a soil free from nitrogen some leguminous plants, furnished with an extract from a soil in which leguminous plants have grown, do gain nitrogen, and show a luxuriance in growth not to be accounted for by the small addition to the food of the plant."

In my own experiments with soil microbes there are striking indications of their ability to take lime and potash from the compound silicates under certain conditions. Glass tubes, in which these organisms have been cultivated, are deeply etched by the action of the microbes, and they likewise readily appropriate the lime from solid masses of gypsum, and the potash from pieces of feldspar. These facts are certainly suggestive in their relations to the fertility of soils.

In calling attention to the agency of microbes in elaborating plant food, Dr. Masters, in his admirable book, "Plant Life on the Farm," says: "These bacteria occur in all fermenting material, such as farmyard dung, whose value as manure is in part accounted for by their presence and agency. It is probable in the future that just as the brewer uses his yeast to secure the conversion of starch into sugar, and the chemist 'seeds' his solutions to effect the changes he wishes to bring about, and just as the gardener sows the spawn or germs of mushrooms in his mushroom bed, and obtains thereby a crop of succulent fungi, so the farmer may be able to apply to the soil the ferment-producing germs needed to change its quality and render it available for plant food. When we have arrived at that point manuring will be reduced to a science, and a pinch of the right material will be as efficient as a ton of our present compounds, the larger part of which are undoubtedly wasted under existing circumstances." These speculations in regard to the possible results of an intimate acquaintance with the immediate and remote relations of microbes to soil fertility may not be realized, but they are nevertheless suggestive, and should be recognized as indications of the great practical importance of the study of the life history of these minute organisms, on which the profitable management of our farms so largely depends.

**Exhaustion of Soils.** — From the crude popular notions in regard to the exhaustion of soils, which are undoubtedly to be attributed to the diffusion of one-sided and superficial

views that ignore many of the factors of dominant interest, a review of some of the known facts relating to the subject may profitably be made. The Rothamsted field experiments with crops grown continuously on the same land for many years have led to the recognition of the distinction that should be made between the "natural strength" or "natural fertility" of soils, and their "condition" or acquired fertility, in discussing the subject of exhaustion.

The terms "natural strength" or "natural fertility" are used to indicate the productiveness of a soil resulting from its original constitution, which remains comparatively constant, and is not rapidly or materially reduced by continuous cropping. For example, a heavy loamy soil at Rothamsted has been continuously cropped for many years with wheat, and barley, and grass, without the application of manure of any kind. Where wheat has been grown every year, on the same land, for forty years, without manure, the average yield has been 14 bushels per acre; barley, under the same conditions, for thirty-six years has yielded an average of nearly 18 bushels per acre; and meadow has given an average yield of 2,535 pounds of hay for twenty years. These crops may be taken as representing the natural fertility of this soil, and the indications are that similar yields may be obtained for many years to come. It will require a long series of years, with such crops, to produce an impression on the soil and subsoil that is sufficiently marked to be made evident by chemical analysis. This natural fertility, then, represents the permanent capital of the farm.

Where this same Rothamsted soil was highly manured, average yields of 35 bushels of wheat and 46 bushels of barley were obtained when grown every year on the same land. These increased yields represent the "condition" of the soil, brought about by the application of manure. When soils are in high condition, large crops may be grown, but this is more or less rapidly reduced by cropping when no manure is applied.

What is included in the general term condition may therefore be reckoned as part of the floating or circulating capital of the farm, that must be husbanded with care in order to obtain from it the best returns, with the smallest amount of loss, in the round of circulation it is fitted to perform.

The amount of plant food contained in an average soil, representing its natural fertility and condition, where it has been fairly managed, is very large; but a large proportion of it is slowly available as plant food, and, with moderate crops, it will last many years. From the average analyses of a number of soils of various descriptions, Drs. Lawes and Gilbert made an estimate that, under an ordinary rotation, when the barnyard manure was returned to the soil, and only grain and animal products were sold, it would require "about 1,000 years to exhaust as much phosphoric acid, and about 2,000 years to exhaust as much potash," as these soils contained to the depth of one foot, that was soluble in dilute hydrochloric acid. But the roots of plants extend much deeper than this, and the supplies of fertility from the subsoil are not insignificant. Sir John Lawes estimates the soil at Rothamsted in pasture to contain from 10,000 to 11,000 pounds of nitrogen per acre, to the depth of three feet; and the arable land from 8,000 to 9,000 pounds.

Dr. A. Voelcker analyzed two samples of soil from a clover field that "had not previously been very productive," and the average amount of phosphoric acid and nitrogen, in pounds per acre, was as follows:

| | In 1st six inches of soil. Lbs. | In 2d six inches of soil. Lbs. | In 3d six inches of soil. Lbs. | Total in eighteen inches of soil. Lbs. |
|---|---|---|---|---|
| Phosphoric acid, | 4,462 | 3,437 | 3,537 | 11,436 |
| Nitrogen, | 4,037 | 2,612 | 1,775 | 8,424 |

With a yield of 20 bushels of wheat per acre, and the amount of phosphoric acid and nitrogen in the grain as given in the table on p. 39, vol. I, the phosphoric acid in the first six inches of soil would be sufficient for 469 crops, and in the eighteen inches of soil for

1,200 crops; while the nitrogen of the first six inches of soil would supply 161 crops, and in the eighteen inches of soil 337 crops. In this estimate no account is taken of the amount of these elements in the straw which should be returned to the soil as manure, or of the root-residues remaining in the soil, which of course would contain nutritive material drawn from the deeper layers of the subsoil, or of other conservative compensating agencies that might reasonably be considered as sources of fertility. The dangers of immediate soil exhaustion, from the sale of animal products and grain from the farm, do not therefore appear to demand serious attention.

In the *Popular Science Monthly* I made the following statement in regard to the dangers of soil exhaustion: "It does not aid the farmer in the ordinary routine of his work, or place him in a better position to overcome the evils of the intense competition to which he is subjected, to urge upon him the dangers of soil exhaustion from the loss of the elements of fertility in the products sold from the farm. Profitable farming can only be practiced where the surplus products of the farm can be disposed of at remunerative rates in the markets of the world; and these products must, of course, contain chemical constituents that might, under proper conditions, be looked upon as elements of fertility. But of what use are elements of fertility if they cannot be sold and made to contribute to the legitimate income that is the object of the farmer's labors?

"American farmers will continue to sell grain and animal products of various forms as long as there is a demand for them outside of their farms, and this is, of course, the only available resource of profitable production; but they need not fear the evils of soil exhaustion from this source, notwithstanding the warnings of alarmists who overlook the complex compensating agencies of nature, and fail to recognize the real sources of diminished production. The history of agriculture and our knowledge of science agree in teaching that the causes of diminished productiveness that are often noticed and referred to as indications of soil exhaustion, cannot be exclusively attributed to the loss of constituents removed from the soil in the crops sold from the farm, but rather to the failure to conserve the available elements of fertility, and keep them in active circulation, by a judicious system of cropping and soil management. If the fertilizing constituents of the barnyard manure which are now wasted were utilized by being converted into farm products of marketable value, the gross agricultural exports of the United States might be more than doubled without making our soils appreciably poorer in any of their essential constituents."

**Soil Fertility — How Lost.** — The elements of fertility contained in the crops sold from the farm cannot, therefore, furnish any satisfactory indication of the amount of soil exhaustion involved in the system of management under which the crops are grown. We must, then, try to ascertain the causes of the avoidable losses of soil fertility, and the available means of preventing them.

Of the twelve or thirteen chemical elements found in plants the nitrogen, potash, and phosphorus are the only ones that are likely to be deficient in the soil, as the natural supplies of the others are ample under ordinary conditions. In seeking the sources of the loss of fertility we may therefore confine our attention to these three elements, and of these nitrogen is undoubtedly the most important.

In the metabolism of soils which is constantly taking place, from the action of microbes and other agencies, to which reference has already been made, the nitrogen of the soil and the manures is made more soluble by the process of nitrification, and, if not immediately appropriated by the roots of growing plants, it is liable to be washed by the rains into the subsoil, and finally lost by drainage. A loss of potash and phosphoric acid may take place in the same way, but, under ordinary conditions, this is inconsiderable.

The experiments which have been conducted by Dr., now Sir, John Bennet Lawes and

Dr. J. H. Gilbert, at Rothamsted, England, for nearly half a century, furnish the best data for the discussion of the changes taking place in soil nitrogen. In 1873 three drain-gauges were made, each enclosing one-thousandth of an acre of soil, with a depth respectively of 20, 40, and 60 inches. The soil of the gauges was in its natural condition, and it was "kept bare of vegetation," representing in effect a bare fallow.

In the following table the average amount of rainfall, the average amount of drainage, and the nitrogen in the form of nitric acid in the drainage waters, are given for the different months of the harvest year. The drainage and nitrogen columns represent the average results of the three drain-gauges. For convenience of reference the nitrogen of the drainage water is given in pounds per acre:

TABLE 1.

*Summary of results relating to Rainfall and Drainage of the Drain-Gauges at Rothamsted.*

| MONTHS. | Average of 17 years, Sept., 1870, to Aug., 1887. | | | Average of 10 years, Sept., 1877, to Aug., 1887. |
|---|---|---|---|---|
| | Rainfall. | Drainage. | Difference Retained by Soil, or Evaporated. | Nitrogen as Nitric Acid in Drainage Water. Pounds per Acre. |
| | Inches. | Inches. | Inches. | Pounds. |
| September, | 2.94 | 0.94 | 2.00 | 3.55 |
| October, | 3.43 | 1.81 | 1.62 | 5.75 |
| November, | 3.02 | 2.17 | 0.85 | 5.85 |
| December, | 2.55 | 2.01 | 0.54 | 4.43 |
| January, | 2.67 | 2.23 | 0.44 | 3.56 |
| February, | 2.17 | 1 60 | 0.57 | 3.73 |
| March, | 1.59 | 0.65 | 0.94 | 0.94 |
| April, | 2.25 | 0.74 | 1 51 | 1.61 |
| May, | 2.22 | 0.54 | 1.68 | 1.47 |
| June, | 2.45 | 0.56 | 1.89 | 1.48 |
| July, | 2.76 | 0.62 | 2.14 | 1.37 |
| August, | 2.41 | 0.54 | 1.87 | 2.51 |
| Total, | 30.46 | 14.41 | 16.05 | 36.25 |
| Last harvest year, Sept., 1887, to Aug., 1888. | 30.51 | 14.75 | 15.76 | 38.56 |
| Current harvest year, 9 months, Sept., 1888, to May, 1889. | 20.88 | 11.94 | 8.94 | 24.29 |

It will be observed that the drainage is less, in proportion to rainfall, in the warmer months, from March to September, when the evaporation from the soil is greatest, and that the loss of nitrogen, as nitric acid, is greatest from August to December, or in the months following the highest summer temperature (July), when the process of nitrification is most active. The annual loss of nitrogen from the soil of these drain-gauges has been at the rate of over 36 pounds per acre for a period of twelve years. When we consider that the nitrogen contained in a good average crop of wheat or barley is from 40 to 45 pounds, in grain and straw, the significance of this loss by drainage, from an unmanured bare fallow, is apparent.

The drainage from the plots on which wheat has been grown every year for 45 years, without manure, and with a variety of fertilizers, will now be of interest for comparison with the results presented in this table.

The experimental wheat plots have an area of 11¾ acres, and in 1849 tile drains were laid through the middle of each plot; facilities for collecting the drainage waters from each

plot were not, however, completed until 1879. Since that time a record has been kept of "the date on which each drain ran" and the size of the flow, and analyses of the drainage waters have from time to time been made. For two years (spring of 1879 to spring of 1881) an analysis was made of every running of the drains. For our present purpose further details are unnecessary, and a summary of the results obtained are given in Tables 2, 3, and 4:

TABLE 2.

NITROGEN *supplied in* MANURE, *recovered in the* CROP *and in the* DRAINAGE, *and unaccounted for in either* CROP *or* DRAINAGE, *in the* EXPERIMENTAL WHEAT FIELD. TWO YEARS.
*In pounds per acre.*

| Plots. | | Nitrogen per Acre per Annum. | | | | |
|---|---|---|---|---|---|---|
| | | In Manure. | In Crops. | In Drainage. | In Crop and Drainage. | Un-accounted for. |
| | | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| 3 and 4 | Unmanured continuously, . . . . . | 0 | 12 | 15 | 27 | (+ 27) |
| 5 | Mixed Mineral Manure, . . . . . . | 0 | 16 | 17 | 33 | (+ 33) |
| 6 | Mixed Mineral Manure and 200 lbs. Ammonia-salts, . . . . . . . . . . | 44 | 27 | 22 | 49 | (+ 5) |
| 7 | Mixed Mineral Manure and 400 lbs. Ammonia-salts, . . . . . . . . . . | 88 | 40 | 28 | 68 | 20 |
| 8 | Mixed Mineral Manure and 600 lbs. Ammonia-salts, . . . . . . . . . . | 132 | 49 | 43 | 92 | 40 |
| 9 | Mixed Mineral Manure (on half) and 550 lbs. Nitrate Sodium, . . . . . . . | 86 | 32 | 58 | 90 | (+ 4) |
| 10 | 400 lbs. Ammonia-salts, alone, . . . | 88 | 14 | 50 | 64 | 24 |
| 11 | 400 lbs. Ammonia-salts and Superphosphate, . | 88 | 29 | 39 | 68 | 20 |
| 12 | 400 lbs. Ammonia-salts, Superphosphate, and Sulphate Sodium, . . . . . | 88 | 32 | 35 | 67 | 21 |
| 13 | 400 lbs. Ammonia-salts, Superphosphate, and Sulphate Potassium, . . . . | 88 | 38 | 32 | 70 | 18 |
| 14 | 400 lbs. Ammonia-salts, with Superphosphate and Sulphate Magnesia, . . . | 88 | 37 | 37 | 74 | 14 |
| 15 | 400 lbs. Ammonia-salts, and Mixed Mineral Manure, . . . . . . . . | 88 | 32 | 74 | 106 | (+ 18) |
| 16 | Unmanured, 1865 and since, . . . . | 0 | 14 | 16 | 30 | (+ 30) |

The increased loss of nitrogen by drainage, as the amount of nitrogen in the manures is increased, is striking, and in several instances (plots 9, 10, 11, 12, and 15,) it exceeds the amount removed in the crop. It is also worthy of notice that on the unmanured plots (3 and 4, and 16), and plot 5, where no nitrogen was applied in the manure, the nitrogen of the drainage waters exceeds that removed in the crop. Another point of interest should not be overlooked. The nitrogen in the crop and drainage of the three plots to which no nitrogen was applied evidently came from the soil, as it is very much in excess of the amount of combined nitrogen that could be supplied in the rainfall. On plots 6, 9, and 15, receiving liberal applications of nitrogen in the manure (that is to say the nitrogen in the manure is in excess of that in the crop) the nitrogen in crop and drainage exceeds that supplied in the manure. From this it appears that the nitrogen of the soil itself must have been used in the crop, or lost by drainage, notwithstanding the excessive supply of nitrogen in the manure.

The nitrogen "unaccounted for" on plots 7, 8, 10, 11, 12, 13, and 14, may have been partly retained in the soil, but it is probable that a considerable portion was lost by being changed to free nitrogen and escaping to the air through the agency of the denitrifying microbes to which reference has been made. It is also probable that part of the loss was caused by the percolation of nitrogen to the lower strata of the soil without being accounted for in the drainage waters.

The estimated aggregate loss of nitrogen by drainage for selected series of years is given in the following table :

TABLE 3.

ESTIMATED AVERAGE LOSS *of* NITROGEN *as* NITRATES, *in the collected* DRAINAGE-WATERS *from the different* PLOTS *in the* EXPERIMENTAL WHEAT FIELD.

THIRTY YEARS, IN POUNDS PER ACRE, PER ANNUM.

| PLOTS. | 19 Years, 1851-2 to 1869-70. Lbs. | 7 Years, 1870-1 to 1876-7. Lbs. | 1 Year, 1877-8. Lbs. | 3 Years, 1878-9 to 1880-1. Lbs. | 30 Years, 1851-2 to 1880-1. Lbs. | 2 Years, 1879-80 to 1880-1. Lbs. |
|---|---|---|---|---|---|---|
| 3 and 4 | 9.1 | 11.1 | 11.8 | 15.9 | 10.3 | 15.2 |
| 5 | 10.6 | 13.2 | 13.6 | 17.3 | 12.0 | 16.7 |
| 6 | 17.3 | 22.7 | 20.9 | 20.7 | 19.0 | 22.4 |
| 7 | 28.9 | 38.9 | 31.6 | 25.8 | 31.0 | 28.3 |
| 8 | 39.9 | 53.2 | 40.5 | 34.3 | 42.5 | 42.5 |
| 9 | 32.5 | 35.6 | 60.3 | 48.0 | 35.7 | 58.3 |
| 10 | 40.4 | 49.4 | 48.2 | 44.8 | 43.2 | 49.9 |
| 11 | 38.1 | 49.6 | 38.5 | 35.2 | 40.5 | 39.5 |
| 12 | 34.3 | 45.7 | 34.2 | 30.1 | 36.5 | 34.6 |
| 13 | 35.4 | 48.2 | 35.9 | 27.7 | 37.6 | 32.2 |
| 14 | 36.9 | 49.4 | 42.0 | 32.1 | 39.5 | 36.5 |
| 15 | 34.3 | *23.3 | 58.9 | 63.5 | 35.5 | 74.0 |
| 16 | 11.9 | 14.7 | 14.8 | 16.6 | 13 1 | 16.4 |

* Ammonia-salts for five years, spring-sown.

These estimates " differ from one another in the direction that it would be expected they would do, having regard to the difference in the characters of the seasons, to the average character of the crops accordingly, and to the time of year at which the ammonium-salts were sown." In the column giving the average loss of nitrogen per acre, for seven years, it will be seen that the loss of 23.3 pounds on plot 15 is very much less than the average for the preceding 19 years, or than in the next year. This is readily explained by the fact that in five of the seven years the ammonium-salts were sown in the spring, and the growing crop could immediately appropriate them, while in the 19 previous years, and in the years 1887–8 the ammonium-salts were applied in the fall, and to a considerable extent wasted by the fall rains before the growing crop could make use of them.

This suggests the inquiry as to the influence of a growing crop in conserving the elements of fertility that might otherwise be lost. This is clearly shown in Table 4, in which the year is divided into two periods, the one covering the time of growth and ripening of the crop, and the other the interval from harvest to next year's seeding, when no crop was on the ground :

TABLE 4.

*Showing the estimated loss of* NITROGEN, *as* NITRATES, *in the* DRAINAGE-WATERS *from the* EXPERIMENTAL WHEAT FIELD *for two years, in which analyses were made of every running from the drain pipes. In pounds per acre.*

| Plots. | Fertilizers Applied. | Estimated Loss for the Harvest Year 1879-80. | | | Estimated Loss for the Harvest Year 1880-81. | | | Average for the 2 years. |
|---|---|---|---|---|---|---|---|---|
| | | From spring sowing to harvest. lbs. | From harvest to next spring sowing. lbs. | Total for the year. lbs. | From spring sowing to harvest. lbs. | From harvest to next spring sowing. lbs. | Total for the year. lbs. | For both periods, or total. lbs. |
| 3 and 4 | Unmanured continuously, | 1.74 | 10.82 | 12.56 | 0.59 | 17.13 | 17.71 | 14 94 |
| 5 | Mixed mineral manure, | 1.56 | 13.32 | 14.88 | 0.74 | 17.73 | 18.47 | 16.68 |
| 6 | " " and 200 lbs. ammonia-salts, | 10.12 | 12.56 | 22.68 | 2.25 | 19.81 | 22.06 | 22.37 |
| 7 | " " and 400 lbs. " | 18.31 | 12.63 | 30.94 | 4.29 | 21.38 | 25.67 | 28.31 |
| 8 | " " and 600 lbs. " | 24.95 | 17.55 | 42.50 | 8.70 | 33.81 | 42.51 | 42.50 |
| 9*a* 9*b* | " " and 550 lbs. nit. of sodium, 550 lbs. nitrate of sodium, | 44.99 | 15.61 | 60.60 | 15.03 | 40.99 | 56.02 | 58.31 |
| 10 | 400 lbs. ammonia-salts alone, | 42.87 | 14.35 | 57.22 | 7.38 | 35.24 | 42.62 | 49.92 |
| 11 | 400 lbs. ammonia-salts and superphosphate, | 28.29 | 17.75 | 46.04 | 3.37 | 29.57 | 32.94 | 39.49 |
| 12 | 400 lbs. ammonia-salts, superphosphate, and sulphate sodium, | 21.25 | 17.57 | 38.77 | 3.32 | 27.17 | 30.49 | 34.63 |
| 13 | 400 lbs. ammonia-salts, superphosphate, and sulphate of potass., | 19.01 | 16.43 | 35.44 | 3.68 | 25.33 | 29.01 | 32.23 |
| 14 | 400 lbs. ammonia-salts, superphosphate, and sulphate mag., | 25.99 | 16.85 | 42.84 | 4.25 | 25.94 | 30.19 | 36.51 |
| 15 | 400 lbs. ammonia-salts and mixed mineral manure, | 9.62 | 59.92 | 69.54 | 3.40 | 74.94 | 78.34 | 73.94 |
| 16 | Unmanured, 1865, and since, | 1.61 | 12.63 | 14.24 | 0.76 | 17.86 | 18.62 | 16.43 |

*Estimated Drainage for the same periods.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Drainage through the 60 inches of soil of the drain-gauge, | 11.1 | 4.7 | 15.8 | 1.8 | 18.8 | 20.6 | 18.20 |

It should be noted that the mean annual rainfall for the two years was 34.8 inches or nearly 6.5 inches above the average of the thirty years the experiments had been in progress; and the drainage of over 18 inches from the 60-inch soil-drain-gauge is about 8 inches in excess of the average for eleven years. From these facts it may be inferred that the loss of nitrogen by drainage, as shown by the table, is somewhat in excess of the average; but, on the other hand, it would not be safe to assume that all of the nitrogen reaching the lower strata of the subsoil is discharged in the drains, and the real loss may considerably exceed the amounts indicated in the table.

As illustrations of the possible loss of the elements of fertility by drainage, they are certainly suggestive, and some of the results are of great practical importance.

There is quite a close agreement in the columns representing the total loss of nitrogen in each of the two years, but there are marked differences in the distribution of it in the two periods into which the year is divided, particularly on the plots that received nitrogenous manures, but these are readily explained by differences in the distribution of the rainfall.

On plots 3 and 4, 5 and 16, that had no nitrogen applied to them in the form of manure, the nitric acid, in both years, was evidently taken up by the growing crops nearly as fast as it was formed in the process of nitrification of the soil, and but little loss occurred in either year, during this period, on these plots. When the crop was harvested, however, the nitrification of the soil was most active, and as there were no growing plants to utilize the nitric acid as it was liberated, it appeared in large quantities in the drainage water. The same

holds true on all of the plots for the year 1880–81, and it is clearly seen that the loss of nitrogen was comparatively small during the period of the growing and ripening of the crop, but after harvest there was a great increase of nitrogen in the water discharged by the drains.

In the year 1879–80 the spring rains were much heavier during the growth of the crop than in the following year, as shown by the table in the drainage from the 60-inch drain-gauge, and the heavy rainfall immediately after the fertilizers were applied will account for the larger loss of nitrogen in the first period of the year on the plots to which nitrogenous manures were applied. It was evidently washed out of the soil before the growing crop could make use of it. Even on the unmanured plots the loss of nitrogen, although comparatively small, was more than twice as large as in 1880–81 during the growing period.

A comparison of the average loss of nitrogen from the bare unmanured soil of the drain-gauges and that from the unmanured plots of the wheat field furnishes a still more striking illustration of the influence of a growing crop in conserving the soluble nitrogen of the soil. From the drain-gauges the annual loss of nitrogen averaged 36.25 pounds per acre (see Table 1), while on the wheat plots it was only from 9.1 to 16.6 pounds per acre. "So complete is the appropriation of nitrates by the wheat crop that during the time of active growth, and for some time after, no nitric acid, or a trace only, can be found in the drainage-water from several of the plots."

The practical applications of the results of these experiments are obvious. In the metabolism of soils, plant food in the form of available nitrogen is constantly liberated from the constituents of the soil and manures, and a loss of this most valuable element of plant growth can largely be prevented by keeping the soil constantly occupied with a succession of growing crops.

**Barnyard Manure Plot.** — In the tables that have thus far been given of the drainage results at Rothamsted, the plot to which barnyard manure was applied at the annual rate of 14 tons per acre, has been omitted. It presents some peculiarities that are of interest in relation to the conservation of the elements of fertility, which may now be noticed.

While the drains of every one of the other experimental wheat plots "*run freely*, perhaps on the average, four or five times annually, the rain from the dunged plot seldom runs at all more than once a year ; indeed, it has not with certainty been known to run, though closely watched, since about this time last year." The plot to which rape cake is applied presents nearly the same physical conditions as that dressed with barnyard manure, from the accumulations of organic matter, and the drain from it seldom runs. In the case of the drain from the barnyard manure plot some obstruction was suspected, but the drain on examination appeared to be in perfect working order, and there was no accumulation of water in the lower strata of the soil to indicate lack of drainage. Obviously "the result was due to the *greater power of absorption and retention of water by the dunged soil near the surface*." To test the correctness of this explanation, samples of soil were taken every three inches to the depth of three feet, on three plots, in July, after a prevailing drought of three months' duration, and again the next January, "after much rain the preceding ten days," when the drains were running and the ground was supposed to be nearly saturated with water.

The results of these examinations are given in Tables 5 and 7. Plot 3 had been without manure for twenty-nine years ; Plot 2 had received 14 tons of barnyard manure per annum, and Plot 8ª had been manured every year with a mixture of mineral manures and 600 pounds of ammonia-salts. The July samples of soil were taken just before the crop was ripe. From the yield obtained when the crop was harvested it had not been materially

injured by the drought. The yield of wheat per acre for the three plots was 16⅝ bushels on Plot 3, which was above the average ; 42⅛ bushels on Plot 2, and 44 bushels on Plot 8ª.

TABLE 5.

*Percentages of* MOISTURE *in* SUMMER *and* WINTER, *in the* SOIL *at different depths, of* PLOTS *in the* EXPERIMENTAL WHEAT FIELD, *differently manured.*

| Numbers of Samples, each three inches deep. | Collected in July. | | | Collected in January. | | |
|---|---|---|---|---|---|---|
| | Plot 3, no Manure. | Plot 2, Barnyard Manure. | Plot 8ª, Mixed Mineral Manure and 600 pounds Am.-Salts. | Plot 3, no Manure. | Plot 2, Barnyard Manure. | Plot 8ª, Mixed Mineral Manure and 600 pounds Am.-Salts. |
| 1 | 4.05 | 4.48 | 4.31 | 21.43 | 39.67 | 26.53 |
| 2 | 7.20 | 7.01 | 6.07 | 24.54 | 35.62 | 22.93 |
| 3 | 8.91 | 7.38 | 6.66 | 24.35 | 28.85 | 20.62 |
| 4 | 10.65 | 8.14 | 8.45 | 21.41 | 23.95 | 24.07 |
| 5 | 11.24 | 9.98 | 12.44 | 22.07 | 20.59 | 24.84 |
| 6 | 13.20 | 12.26 | 14.34 | 21.48 | 21.07 | 24.79 |
| 7 | 14.03 | 12.51 | 15.20 | 21.82 | 26.96 | 23.69 |
| 8 | 15.09 | 12.91 | 16.86 | 23.59 | 24.87 | 28 98 |
| 9 | 16.84 | 13.78 | 17.98 | 24.74 | 25.75 | 27.01 |
| 10 | 18.03 | 13.45 | 18.53 | 25.71 | 25.34 | 28.59 |
| 11 | 14.64 | 14.49 | 17.76 | 23.97 | 25.18 | 28.93 |
| 12 | 15.44 | 16.11 | 16.85 | 22.94 | 22.75 | 27.40 |
| Mean, | 12.44 | 11.04 | 12.95 | 23.17 | 26.71 | 25.70 |

The suggestion will naturally be made that on the plots bearing the heaviest crop the soil will be shaded so that the evaporation from the surface soil would be less than when the lighter crop furnished less protection. This may be true, but there are other facts of greater significance in promoting the loss of moisture than evaporation. In the Rothamsted experiments it was shown that from 250 to 300 pounds of water were exhaled by cereal and leguminous crops for each pound of dry substance stored up by the plant. In an ordinary farm crop we may estimate the water exhaled per acre at about 700 tons. The larger the crop the greater the demand for moisture in the soil. The following table shows the number of tons of water per acre in cropped and uncropped land, to the depth of fifty-four inches, at Rothamsted.

TABLE 6.

*" Tons of Water per Acre, to the depth of 54 inches, in Fallow Land and Land Cropped with Barley," June 27 and 28, 1870.*

| | Water per Acre. | | |
|---|---|---|---|
| | Fallow Land. Tons. | Barley Land. Tons. | Difference. Tons. |
| According to experimentally determined weights of soils, . | 2875 | 1951 | 924 |
| According to assumed average weights of soils, . . . . . | 2668 | 1775 | 893 |
| Mean, . . . . . . . . . . . . . . . . . . . | 2772 | 1863 | 909 |

"The indication is that there were about 900 tons less water per acre in the soil and subsoil, to the depth of 4 feet 6 inches, where the barley had grown than where the land was fallow." This enormous demand of a growing crop for water has an influence on drainage and the distribution of the soil nitrogen that should not be overlooked in discussing these subjects.

Returning now to Table 5, we find that in all of the samples of soil collected in July there is a gradual increase in moisture, downwards from the surface, until about the eleventh three inches, when the influence of the tile drains is apparently seen. The barnyard manure plot retains more moisture at the surface, but below the depth of nine inches there is less moisture than in either of the other plots. In this season of drought the barnyard manure plot has evidently parted with a larger proportion of its moisture for the benefit of the growing crops than the others have done, and this should be considered an advantage of considerable importance.

In January, after heavy rains, the surface soil, to the depth of one foot, of the barnyard manure plot, contained very much more moisture than the other plots, but in the subsoil it has less. This accords with the observed difference in the frequency and amount of drainage in the different plots. One of the obvious effects of the barnyard manure is to store up and conserve the soil moisture near the surface, and make a larger proportion of it available for the growth of plants.

In Table 7 the results of the soil analyses with reference to moisture are given in a different form that will perhaps be more readily understood than the statement in percentages.

TABLE 7.

*Tons of* WATER *per Acre, to the depth of three feet, in the Soils of the* ROTHAMSTED WHEAT PLOTS.

| PLOTS. | Sample of Soil in July, Dry. Tons. | Sample of Soil in January, Saturated. Tons. | Difference. Tons. |
|---|---|---|---|
| Plot 3, unmanured, . . . . . . . . . . . . . . . . . | 666 | 1396 | 730 |
| Plot 2, barnyard manure, . . . . . . . . . . . . . . | 591 | 1610 | 1019 |
| Plot $8^a$, mineral manures and ammonia-salts, . . . . . . | 694 | 1549 | 855 |
| *Tons of Water per Acre over (or under) Plot 3.* | | | |
| Plot 2, barnyard manure, . . . . . . . . . . . . . . | —75 | 214 | 289 |
| Plot $8^a$, mineral manure and ammonia-salts, . . . . . . | 28 | 153 | 125 |

In commenting on this table, Drs. Lawes and Gilbert say, "A very remarkable point connected with these results is the difference in the amount of water retained, per acre, to a given depth by the soils of the different plots when saturated. It is the dunged plot, with its vast accumulation of organic matter near the surface, and its finely divided and dissolved products of decomposition permeating to a greater or less depth beyond, and doubtless a considerable development of root, that is seen to possess the greatest power of retention of moisture, especially near the surface.

"Taking the figures relating to the saturated soils as they stand, the artificially manured plot ($8^a$) retained 153 tons, and the dunged plot (2) 214 tons more water per acre to the depth examined than the unmanured, — amounts which represent respectively about 1½, and more than 2 inches of rain. Or, if we take the difference between the amounts retained in the dry and the wet conditions, the dunged soil shows a still greater

excess of absorption when saturated, both compared with the unmanured and with the artificially manured soils.

"Further, the details show that the dunged soil, when saturated, retained, within 12 inches of the surface, an excess of water which would be equivalent to about 1½ inches of rain more than that held to the same depth on either of the other plots.

"From the results adduced it may safely be considered, as already intimated, that the three plots would retain different amounts of water, due to the previous winter rains at the time of the commencement of active vegetation in the spring; and although the actual amounts of excess indicated by the figures in Table 7 may not be true measures of the increased retention by the manured, as compared with the unmanured soil, and although the excess at any one time may not be sufficient to meet the increased requirements of the manured crop, it must be supposed that the soils of higher retentive power would retain proportionally more of every heavy shower falling from time to time during growth; and hence may be accounted for the differences, not at first sight adequately explained, in the amounts of water retained by the different soils at the period when they had supported and nearly carried to completion such widely different amounts of crop."

The experiments at Rothamsted to determine the nitrogen at different depths in soils where the same crop has been continuously grown for many years, but under different conditions as to manure supply, are of great interest, in connection with the results of drainage and the distribution of soil moisture, which have already been presented.

TABLE 8.

*Estimated* NITROGEN *per acre in the soil of two of the* EXPERIMENTAL WHEAT PLOTS, *on which wheat had been continuously grown for 22 years.*

| Depth of Samples. | Nitrogen in Pounds per Acre. | | |
|---|---|---|---|
| | Plot 3 Unmanured. | Plot 2 Barnyard Manure. | Manured over Unmanured. |
| First depth, 1—9 inches, | 2,493 | 4,304 | 1,811 |
| Second depth, 10—18 inches, | 2,002 | 2,197 | 195 |
| Third depth, 19—27 inches, | 1,598 | 1,764 | 166 |
| Total, 27 inches, | 6,093 | 8,265 | 2,172 |

The greatest difference in the amount of nitrogen in the soil of the two plots is 1,811 pounds in the first nine inches of soil, and at the depth of 19 to 27 inches the difference is but 166 pounds, which would probably be diminished in the strata below, had samples been taken. On the permanent meadow plots, samples of soil were taken and the nitrogen determined to the depth of 54 inches, with similar results as to its relative distribution in the first 27 inches of the unmanured and the barnyard manure plots, while in the next, or lower, 27 inches, the soil of the unmanured plot contains more nitrogen than that of the barnyard manure plot.

TABLE 9.

NITROGEN *in pounds per acre in the soil of two of the* PERMANENT MEADOW PLOTS, *to the depth of 54 inches.*

| DEPTH OF SAMPLES. | NITROGEN PER ACRE. | | |
|---|---|---|---|
| | Plot 3 Unmanured. | Plot 2 Barnyard Manure 8 Years; Unmanured 12 Years. | Plot 2 + or — than Plot 3. |
| | Lbs. | Lbs. | Lbs. |
| First depth, 1—9 inches, | 5,600 | 6,113 | +513 |
| Second depth, 10—18 inches, | 2,053 | 2,407 | +354 |
| Third depth, 19—27 inches, | 1,358 | 1,402 | + 44 |
| Fourth depth, 28—36 inches, | 1,296 | 1,226 | — 70 |
| Fifth depth, 37—45 inches, | 1,183 | 1,046 | —137 |
| Sixth depth, 46—54 inches, | 1,158 | 983 | —175 |
| Total, 27 inches, | 9,011 | 9,922 | +911 |
| Total, 54 inches, | 12,648 | 13,177 | +529 |

Although the barnyard manure had not been applied for the last 12 years of the experiment, the influence of its accumulated residues of the eight preceding years in retaining the nitrogen in the surface soil where it can be utilized by plants, is as marked as in the case of the experimental wheat plots, as shown in Table 8.

The percolation of water through the soil had carried a larger proportion of the nitrogen of the unmanured plot to the lower strata than on the barnyard manure plot. The evidence relating to the nitrogen of drainage waters, the nitrogen of soils at different depths, and the distribution of soil moisture, all lead to the same conclusion, that barnyard manure plays an important role in the conservation of the nitrogen contained in the soil, and we have good reasons for believing that this *indirect* influence is quite as significant in maintaining the fertility of the soil, under certain conditions at least, as the more obvious nutritive materials which it contributes to the soil. We cannot, then, consider the fertilizing constituents of a manure as the sole elements that determine its value when applied to the soil.

**Fallows.** — The early writers on agriculture all agreed that the summer fallow was an important means of increasing the fertility of the soil, but the practice of fallowing was undoubtedly extended from the necessity of destroying the weeds that had been allowed to multiply under the careless system of grain growing that largely prevailed. The introduction of hoed crops in the system of rotation, and the better implements for cultivating them and destroying the weeds that were encouraged by the prominence given to grain growing, soon made the fallow unnecessary for cleaning the land.

The relations of the fallow to the fertility of the soil may now be profitably considered in connection with the causes of soil exhaustion which have been discussed. In land under a bare fallow the metabolism of the soil is actively carried on, and plant food is liberated from the soil in an available form, through the activity of microbes and other agencies

which we need not enumerate. One practical demonstration of this fact has been given in the amount of available nitrogen escaping in the drainage from the drain guages, which represent the essential conditions of an unmanured bare fallow. According to Table 1, the nitrogen, as nitrates, in the drainage from the sixty-inch drain gauge at Rothamsted, averaged 36.5 pounds per acre for ten years (1877–'87) ; but this, of course, will vary with the season and the amount of rainfall, and for single years it may be much larger. The average for the five years ending in 1882 was, in fact, 42.64 pounds per acre.

But the evidence that a loss of fertility takes place on fallow land is not confined to the results obtained with the drain-gauges. We have already noticed (Table 6), the larger amount of water contained in fallow land, in the summer, than in land on which a crop was growing, and, as this is not owing to the higher powers of absorption, as in the case of the barnyard manure plots, the land is in favorable conditions for drainage, whenever there is a considerable rainfall, with a loss of its soluble constituents.

Attention must now be given to the relative amount of nitrogen as nitrates in fallow soils, with reference to its probable loss in the autumn drainage waters. Soils were carefully sampled and analyzed at Rothamsted, and some of the results relating to fallow land are given in Tables 10 and 11.

TABLE 10.

NITROGEN *as* NITRATES *in soil, at* ROTHAMSTED *in* BARE FALLOW (*sampled October, 1881*), *in pounds per acre.*

| | Clay Croft Field. Lbs. | Foster's Field. Lbs. |
|---|---|---|
| First 9 inches, | 16.4 | 14.6 |
| Second 9 inches, | 26.5 | 24.6 |
| Third 9 inches, | 15.9 | 17.3 |
| Total 27 inches, | 58.8 | 56.5 |

Both of these fields were under ordinary farm culture, but fallowed during the summer. The nitrates probably extended considerably below the 27 inches of soil examined, and the total accumulation is not therefore fully represented in the table. The maximum amount of nitrates at the second depth "was owing to heavy rains preceding the time of sampling."

TABLE 11.

NITROGEN *as* NITRATES *in* SOILS *of two of the Experimental Fields at* ROTHAMSTED, *after* CROPPING *and after* BARE FALLOW (*sampled September, 1878*), *in pounds per acre.*

| | AGDELL FIELD. | | | | HOOS FIELD. | |
|---|---|---|---|---|---|---|
| | ROTATION FULLY MANURED. | | ROTATION WITH SUPERPHOSPHATE TO TURNIPS ONLY. | | UNMANURED. WHEAT AND FALLOW, ALTERNATED. | |
| | Beans. Lbs. | Fallow. Lbs. | Beans. Lbs. | Fallow. Lbs. | Wheat. Lbs. | Fallow. Lbs. |
| First 9 inches, | 12.1 | 30.0 | 7.3 | 22.3 | 2.6 | 28.5 |
| Second 9 inches, | 8.4 | 18.8 | 3.3 | 14.0 | trace. | 5.2 |
| Total 18 inches, | 20.5 | 48.8 | 10.6 | 36.3 | 2.6 | 33.7 |

In remarks on these tables, Mr. Warington says: "The experiments in Agdell field are on rotation (since 1848). On one of the plots from which samples were taken the land is always heavily manured for turnips, and the crop fed off on the land. After turnips follows barley, without manure; the plot is then divided, one half carrying beans or clover, and the other half being left as bare fallow. On the other rotation plot the turnips (every fourth year) receive superphosphate only, and are carted off the land; the succeeding treatment being the same as that just mentioned. On this last plot the soil is clearly in a far more impoverished condition than on the plot previously described. In Hoos field wheat and fallow have alternated since 1850, no manure being applied; here also the soil is evidently in an impoverished condition. The figures in the table show that very considerable amounts of nitrates were found in every one of the fallow soils, the quantities being greatest where the land was in the highest condition. In every case the nitrates preponderated near the surface. The results obtained by the analysis of fallow soils thus amply confirm the conclusions arrived at from a study of the waters from the drain-gauges; it is quite evident that very large amounts of nitrates are produced in soil when exposed to air and rain, and kept free from vegetation.

"There can be no doubt that it is in this very considerable production of nitrates that the advantages of a bare fallow consist. If a dry (fall and) winter follow the summer fallow, the wheat crop, for which the fallow has been preparatory, will find at its disposal an amount of nitrates equivalent to a very considerable dressing of nitrate of sodium, and if the season be favorable, a proportionably heavy crop will result.

"In experiments on alternate wheat and fallow, made at Rothamsted, it was found during the first ten years of the experiment that a crop of wheat, after fallow, was, on the average, nearly double the amount of a crop of wheat following wheat; so that five crops of wheat after fallow were nearly equal to ten crops of wheat after wheat. The wheat after fallow had, indeed, in favorable seasons, two years' production of nitrates to feed upon, while in the case of wheat after wheat the nitrates at the disposal of the crop were limited to one year's production.

"The advantages of a summer fallow are, however, clearly dependent on the character of the following (fall and) winter. The large amount of nitrates found in the water percolating through the soil of the drain-gauges shows only too plainly the loss of fertility which drainage during a wet winter will produce. After a wet winter the following crop may show little benefit from a previous summer's fallow. But this is not all, for the land in this case will have actually suffered in condition from the operation of fallowing. As the nitrogenous organic matter of a soil is being constantly converted into nitrates, the stock of organic matter which forms the capital of the fertility of a soil is only maintained by the annual accession of a new crop residue, consisting of the roots, leaves, and stubble remaining after harvest. In the year of summer fallow there is obviously no crop residue, and if a double crop does not result from the operation of fallowing, the net result must be a diminution in the nitrogenous wealth of the soil. In the experiments on alternate wheat and fallow, at Rothamsted, the benefit from the fallow has gradually diminished, and the soil now contains a lower percentage of nitrogen than the soil cultivated continuously with wheat. The net result of the fallow has thus been to lower the condition of the soil."

Without taking into the account the loss of labor and of a year's crop, it must be seen from the facts presented that the summer fallow involves a waste of one of the most important elements of plant food, without any compensating advantages, and that it cannot be consistently practiced on the average farm under the present conditions of production. A fallow may possibly be admissible in beginning an improved practice on land that has become stocked with weeds, from errors in previous management, but it cannot be defended

on the score of economy in a system of farming that aims to obtain the largest returns from the soil without impairing its future productiveness.

**Fall Fallowing.** — There are farmers, however, who have abandoned the expensive summer fallow from economical considerations, who strongly urge the assumed advantages of the quite as objectionable system of fall fallowing. The only valid argument that has been advanced in favor of this modified form of the old-fashioned system is the destruction of weeds ; but this can be better accomplished, and with far greater economy of labor, by the clean cultivation of a hoed crop in a judicious succession, or rotation of crops, in connection with other precautions that will be pointed out in the following pages.

The assumed advantages of forwarding the spring's work by this preliminary process of tillage may, perhaps, be realized under exceptional conditions ; but on land that is not thoroughly drained, and even on a large proportion of the farms of the United States, it will be safe to say that the benefits that may be derived from fall plowing, unless the conditions are peculiarly favorable, are exceedingly doubtful. So far as a tendency to the waste of soil nitrogen, in its most available form as plant food, is concerned, fall fallowing has apparently no advantages over what is now fortunately becoming the obsolete system of summer fallowing.

**Rotation of Crops.** — The rotation of crops under a consistent and proper system may be considered as an efficient means of conserving the elements of fertility and preventing the consequent exhaustion of the soil. It is unnecessary to discuss the various theories in regard to the advantages of crop rotations, or to make an exhaustive summary of the principles involved, and we will therefore call attention only to some of the leading facts relating to the subject that are of practical importance.

In discussing the subject of crop rotations it is well to remember that plant food is constantly liberated from the soil constituents, and that, if it is not utilized by a growing crop, it is liable to be lost or enter into new combinations in the soil, so that it ceases to be immediately available. The problem for the farmer to consider is, the conversion of this available plant food of the soil into valuable crops with the least possible loss.

On the start it will be well to recognize the known fact that the vital endowments and requirements of plants differ, and that each species will take from the soil what it needs, and in the required quantity, under the conditions in which it is placed, and that it cannot be "induced to take more by the addition of larger supplies." From the different demands of each species upon the soil a variety of plants must be grown in order to secure the complete appropriation of the available plant food in the soil, as, when but a single species is grown, there may be a loss of the elements not needed by it, which another species would readily appropriate.

The likes and dislikes of plants as to their food supply present many peculiar features that are not easily explained. Species belonging to the same *genus* may have different habits of feeding, and the manure that would help one may be of little or no benefit to the other. This is clearly shown in the experiments at Rothamsted on the "Mixed Herbage of Permanent Meadow," in the growth of *Poa pratensis* and *Poa trivalis*.

In order to ascertain the relative proportions of the different species on each plot under experiment, and the changes taking place under the different kinds of manure applied, a botanical analysis, or enumeration of species on each plot, was made every five years. The following table will show the percentage of the total produce represented by the two *Poas* mentioned in four assortment years, on two plots receiving the same amount of nitrogen as manure, but in different forms.

TABLE 12.

| Separation Years. | Plot 9. Mineral Manure and Ammonia-salts. | | Plot 14. Mineral Manure and Nitrate of Soda. | |
|---|---|---|---|---|
| | Poa pratensis. | Poa trivialis. | Poa pratensis. | Poa trivialis. |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| 1862, . . . . . . | 10.68 | 8.72 | 1.45 | 22.48 |
| 1867, . . . . . . | 13.02 | 2.14 | 1.05 | 32.93 |
| 1872, . . . . . . | 22.67 | 0.64 | 2.57 | 24.76 |
| 1877, . . . . . . | 18.03 | 0.11 | 4.01 | 21.59 |

The contrast presented in the relative proportions of the two Poas in the total produce of the two plots receiving the same amount of manure, when valued by its constituents, is striking. On plot 9 there is not only a large percentage of the total produce of the plot represented by *Poa pratensis*, but this percentage is decidedly increasing, while *Poa trivialis* has almost disappeared. On plot 14 *Poa pratensis* has slightly increased, but the large percentage of the total produce represented by *Poa trivialis* is the remarkable feature of the plot.

*Poa pratensis* evidently prefers its nitrogen in the form of ammonia-salts, and *Poa trivialis* thrives best when its nitrogen is furnished in the form of nitrate of soda. Whether this is owing to a difference in the diffusion or distribution of the two salts in the soil, and a corresponding difference in the root distribution of the two species, has not been definitely determined. The fact that the relative predominance of each species depends on the form in which the nitrogen is supplied is, nevertheless, evident.

In accordance with this principle in the economy of plants, experience shows that a greater aggregate yield can be obtained from the soil when a variety of crops are grown in succession, or even together, on the same land, than can be secured by the continuous growth of a single crop. In this connection it should be remarked that the chemical composition of a crop furnishes no direct indication of the particular food that can with advantage be supplied to the plant in the form of manure. The cereals, for example, contain but a comparatively small amount of nitrogen, but they are especially benefited by nitrogenous manures, while clover and other leguminous crops, with a much larger proportion of nitrogen in their composition, are not, under ordinary conditions, benefited by nitrogenous manures; and, though drawing largely upon the soil for their required nitrogen leave a residue in the soil that is especially suited to the wants of cereals. This statement is sufficient for our present purpose, but it will be noticed in greater detail in another place.

**Advantages of Crop Rotations.**—The practical advantages of crop rotations and their general tendency to conserve the elements of fertility are forcibly illustrated by a number of the experiments at Rothamsted, which we may now profitably notice.

"In alternating wheat with beans, the remarkable result was obtained, that nearly as much wheat and nearly as much nitrogen were yielded in eight crops of wheat, in alternation with the highly nitrogenous beans, as in sixteen crops of wheat grown consecutively without manure in another field, and also nearly as much as were obtained in a third field in eight crops alternated with bare fallow." The significance of this statement is apparent when we consider that the nitrogen of a crop of beans was a little more than twice the amount found in a crop of wheat, and that nitrogen was the best manure for wheat. Now, after the beans had taken their larger supply of nitrogen from the soil, the yield of wheat the next year was nearly twice that obtained with wheat after another crop of wheat, which took less than half as much nitrogen from the soil, and nearly equal to the crop of wheat after a summer fallow, with its stores of available nitrogen.

Quite as striking a result was obtained in an experiment where barley followed clover. In a field on which six successive grain crops had been grown without manure, and the available nitrogen was presumably exhausted, clover was grown on one-half of the field in 1873, and barley on the other half. In the year 1874, barley was grown on the whole field with results shown in the following diagram. For convenience of reference the yield of each crop is expressed in the amount of nitrogen it contained.

YIELD OF NITROGEN IN POUNDS PER ACRE.

| 1873. | | 1874. | |
|---|---|---|---|
| Clover, . . . . . | 151.3 | Barley after Clover, . . | 69.4 |
| Barley, . . . . . . | 37.3 | Barley after Barley, . . | 39.1 |

In other experiments it had been found that nitrogen was the manure most needed by barley. as was the case with wheat. In the present experiment, where the clover had taken from the soil 151.3 pounds of nitrogen in 1873, the following barley crop obtained 69.4 pounds of nitrogen, while on that part of the field where barley had taken but 37.3 pounds of nitrogen in 1873, the succeeding barley was only able to appropriate 39.1 pounds. The amount of any constituent of plant food taken from the soil by a crop is not, therefore, an indication of a corresponding deficiency of that element in the soil for subsequent crops.

At Rothamsted wheat and barley were grown for 36 years in a 4-years course of rotation of turnips, barley, clover or beans, and wheat. One-third of this land was unmanured (Plot 1); another one-third was manured every fourth year with superphosphate of lime applied to the turnip crop (Plot 2); and the remaining one-third was manured every fourth year with a mixed mineral manure and nitrogen, applied to the turnip crop only. A summary of some of the results are given in Table 13; and for comparison the average yield of wheat and barley, when grown continuously on the same land for 34 years, under similar conditions of manuring, are given in Table 14 :

TABLE 13.

*Average yield of* WHEAT *and* BARLEY *in a 4-years course of* ROTATION *of Turnips, Barley, Clover or Beans, and Wheat, for 36 years, 1848–1883. The fertilizers were applied to the Turnips only.*

| CROP. | Plot 1. No Manure. | Plot 2. Superphosphate of Lime to Turnips only. | Plot 3. Mixed Mineral Manure and Nitrogen to Turnips only. |
|---|---|---|---|
| | Average bushels per acre. | Average bushels per acre. | Average bushels per acre. |
| Wheat, . . . . | $26\frac{1}{4}$ | $28\frac{3}{4}$ | $32\frac{1}{4}$ |
| Barley, . . . . | $33\frac{3}{4}$ | $27\frac{5}{8}$ | 41 |

TABLE 14.

*Wheat and Barley every year on the same land for 34 years. Fertilizers applied every year. Average yield in bushels per acre.*

| CROP. | No Manure. | Superphosphates. Every year. | Mineral Manures alone. Every year. | Mineral Manures, *with* Nitrogen. Every year. |
|---|---|---|---|---|
| Wheat, . . . . . . . . | $13\frac{1}{2}$ | $16\frac{1}{4}$ | $15\frac{1}{2}$ | $32\frac{7}{8}$ |
| Barley, . . . . . . . . | $17\frac{1}{2}$ | $22\frac{1}{2}$ | $23\frac{1}{2}$ | $44\frac{1}{2}$ |

From a comparison of the results presented in these tables it appears, that on the unmanured plots the yield of both wheat and barley is about twice as large on the rotation plot, where they are grown every fourth year, with other crops between, than on the plots where they are grown every year. Nearly the same differences are seen on the plots to which superphosphates were applied, without nitrogen, as on the unmanured plots.

Bearing in mind the fact, already mentioned, that nitrogen gave the best results as a manure for wheat and barley, in the Rothamsted experiments, the yield of nitrogen, in the crop per acre, under the different systems represented in the two tables, will be of interest. The yield of nitrogen per acre and *per annum*, on the unmanured plot in rotation (Table 13), averaged for twenty-eight years 36.8 pounds. On the rotation plot, "with superphosphate of lime alone, which much increased the yield of nitrogen in the turnips, reduced it in the succeeding barley, and slightly in the wheat succeeding them, the average annual yield of nitrogen is increased to 45.2 pounds, or to about double that obtained in either wheat or barley grown consecutively by a complete mineral manure. On this point it may be further remarked that in adjoining experiments in which, instead of a leguminous crop, the land was fallowed in the third year of each course, the total yield of nitrogen in the rotation was very much less.

On the unmanured plot, where wheat was grown every year (Table 14), the yield of nitrogen per acre, for thirty-two years, averaged 20.7 pounds *per annum*, and when the mineral manure without nitrogen was applied the average for twenty-four years was 22.1 pounds *per annum*. On the unmanured plot where barley was continuously grown (Table 14) the yield of nitrogen per acre, for twenty-four years, averaged 18.3 pounds *per annum*, and on the plot receiving mineral manure, with no nitrogen, the average for the same period was 22.4 pounds *per annum*.

On the unmanured rotation plot the yield of both wheat and barley was therefore doubled, notwithstanding the annual removal of from 16 to 18 pounds of nitrogen from the soil, more than was annually taken off on the plots where they were grown every year; and on the superphosphate rotation plot (Table 13), the amount of nitrogen annually removed from the soil per acre, over what was carried off in the crop where wheat and barley were continuously grown, was over 23 and 22 pounds, respectively.

In both Tables 13 and 14 it is seen that the superphosphate and the mixed mineral manures without nitrogen have had but little effect in increasing the crop. Where the mineral manures with nitrogen were applied there is but little difference in the results obtained, under the different conditions of their application, so far as the yield of crop is concerned, as will be seen on comparing the last columns of the tables. It must, however, be noted that in the rotation experiments the manures were applied every fourth year to the turnips only, and not direct to the wheat and barley; while in the experiments in which wheat and barley were grown continuously on the same land, the manures were applied in liberal quantity every year. From the high manuring, and the continuous growth of the same crop from year to year on the same land, the wastes of the elements of fertility were undoubtedly greater than on the rotation plots where a variety of crops, with different feeding habits, and different root distribution, were grown.

The facts thus far presented in regard to crop rotations in their relations to soil exhaustion, show conclusively that the removal of nitrogen from the soil in crops does not necessarily diminish the available supply to crops, like the cereals, that are characteristically benefited by nitrogenous manures, and it is evident that crop rotations have an influence in utilizing and conserving the fertility of the soil that is of great practical importance in a consistent system of farm management.

The inherited feeding habits of plants, that determine their choice of food, and their

ability to obtain it in proper quantity when it is abundantly present in the soil, but not in the most available form for their use, are widely different; but it is difficult to formulate the dominant characteristics of each group so that there are no apparent exceptions. In general terms it may be said that the cereals, or grain crops (and the same, with few exceptions, is true with the whole group of the true grasses to which they belong), obtain their supplies of potash and phosphoric acid more readily than they do nitrogen, and that there is a greater demand for the latter in the manures applied to them. We find, however, that certain species of even the same *genus* differ as to the particular form of nitrogen that is best adapted to their special vital endowments. We have seen (Table 12) that *Poa pratensis* and *Poa trivialis* are not affected alike by nitrogen in the form of ammonia-salts, and as nitrate of soda. The relative growth of these two grasses will therefore depend upon the form of soil nitrogen furnished them in connection with their different root development.

In the experimental wheat at Rothamsted "a given weight of nitrogen, as nitric acid, has produced more growth in the wheat crop than the same weight of nitrogen in salts of ammonia." The average yield of barley for thirty-two years in succession on the same land likewise shows that nitrogen in the form of nitrate of soda had a decided advantage over the same amount of nitrogen in the form of ammonia-salts.

Although the increase of yield is small in both cases when compared with that produced by nitrogen, wheat was decidedly less influenced by superphosphates, as manure, than barley, which contains a smaller proportion of phosphoric acid in its composition; and mixed mineral manures alone gave a greater increase in yield with barley than with wheat.

The leguminous crops (clover, peas, beans, etc.), on the other hand, obtain their supply of nitrogen with greater facility than the cereals; but phosphoric acid and potash, and particularly the latter, are not as readily appropriated, and they have a better effect when applied as manure. Aside from differences in the inherited vital endowments of plants that determine their habits of feeding, the depth to which roots penetrate, and their range of distribution, undoubtedly have an influence on the food supplies they are enabled to obtain from the soil, and on the residues they leave for the nutrition of subsequent crops.

The cereals, with their comparatively superficial fibrous roots, tend to exhaust the nitrogen from the surface soil, while the deeper-rooted leguminous crops draw more largely upon the elements of the subsoil, and their general tendency is to increase the available nitrogen near the surface soil. The advantages of growing grain crops in alternation with leguminous crops, like clover, are therefore readily explained.

It is a popular notion among farmers that wheat and oats are exhausting crops, and that clover and root crops are to be classed as restorative crops. Now if we limit our ideas of exhaustion to the three most important elements of plant food removed from the soil in the crops, and which are most highly valued as manure, this view of the case will be found erroneous. Taking the usual estimates of the average composition of crops, and assuming a yield per acre of wheat, 25 bushels, and $1\frac{1}{4}$ tons of straw; oats, 50 bushels, and 1 ton of straw; corn, 50 bushels, and $2\frac{1}{4}$ tons of stalks; and clover hay $2\frac{1}{4}$ tons, in first and second crops, we have the figures presented in the following table.

TABLE 15.

NITROGEN, POTASH, *and* PHOSPHORIC ACID *removed from the soil in crops; in pounds per acre.*

| CROPS. | Nitrogen. | Potash. | Phosphoric Acid. |
|---|---|---|---|
| Wheat, | 38 | 24 | 17 |
| Oats, | 40 | 26 | 13 |
| Corn, | 78 | 76 | 30 |
| Timothy hay, | 26 | 34 | 11 |
| Clover hay, | 90 | 85 | 25 |

It will be seen that a crop of Indian corn takes from an acre of soil much more of these three elements in question than either wheat, or oats, or timothy hay, and that clover takes considerably more nitrogen and potash than corn, and nearly as much phosphoric acid. The elements of fertility that are likely to become deficient in the soil are removed to a less extent by the so-called exhausting crops, than by corn, or by clover, which is so generally recognized as a restorative crop.

**Why Grain Crops are Exhausting.**—It is, therefore, evident that grain crops are said to be exhausting, not so much on account of what they take from the soil, but from the simple fact that, under ordinary conditions of cultivation, the yield rapidly diminishes each year, when they are grown for several years in succession on the same land. There are several reasons for this diminished yield that are worthy of careful consideration. In the first place, the grain crops take up the available nitrogen nearly as fast as it is liberated, in the processes of soil metabolism, and at harvest-time there is but little nitrogen as nitric acid remaining in the soil. In the Rothamsted wheat-plots, "so complete is the appropriation of nitrates by the wheat-crop, that, during the time of active growth, and for sometime after, no nitric acid, or a trace only, can be found in the drainage-water from several of the plots." In the soils sampled in Hoos Field (see Table 11), at the end of summer, the nitrogen as nitrates in the first nine inches of soil, where wheat was grown, was but 2.6 pounds per acre, while in the fallow land it was 28.5 pounds per acre. In the second nine inches of soil there was but "a trace" of nitrogen in the wheat soil, while the fallow soil gave 5.2 pounds per acre.

The period of growth and maturity with wheat and oats is comparatively short, and the crop is harvested at a time when the nitrification of the soil is most active. After harvest the process of nitrification continues in the bare soil, and the nitrogen is washed out by the fall rains, or weeds are allowed to grow and convert a portion of the nitrogen into organic substances that are slowly available as plant food. Sir John Lawes and Dr. Gilbert consider the exhaustion of the soil, from the loss of nitrogen after the harvest of wheat and oats, as of greater importance than the amount removed in the crop.

On the other hand, clover has a longer period of growth, its roots being active until late in the fall, and it therefore has an opportunity to appropriate the nitrogen made available by nitrification during the whole season, so that the total amount appropriated is much larger, and, what is quite as important, it leaves behind a larger root residue and an accumulation of nitrogen in the surface soil. It takes more in the crop, and, at the same time, leaves more in an available condition for the subsequent growth of cereals. There is no evidence, it may be remarked, that this increased nitrogenous residue is the result of the direct appropriation by the leaves of the plant of the free nitrogen of the atmosphere. Some of its nitrogen is undoubtedly brought from the deeper layers of the soil, and it appears probable that certain species of soil microbes find favorable conditions for the exercise of their vital activities in the immediate vicinity of the clover roots, and that they appropriate the gaseous nitrogen of the air as it permeates the surface soil, and make it available as plant food. From a practical standpoint the fact that leguminous crops increase the available nitrogen in the surface soil is an important one, notwithstanding our inability to fully explain the manner in which it is brought about.

Indian corn is classed with the cereals, but it has two great advantages over the grains, like wheat and oats, in the economies of its growth. It is a cleaning crop, if properly cultivated, and it has a longer period of growth, so that it can, like clover, utilize the nitrogen that is made available in the late summer and early fall, when the process of soil nitrification is actively in progress.

The root crops have a similar advantage in conserving the nitrogen of the soil, as their

growth extends late into the fall and covers the period of the most active nitrification of the soil.

When we come to look upon the elements of the soil that are removed in crops as a legitimate and essential contribution to the income of the farm, and not as an indication of the future impoverishment of the soil, we can then intelligently consider the avoidable causes of diminished productiveness, and adopt a system of management that will enable us to obviate them and make the most of all resources by converting every residue contained in the soil into paying crops.

**Adaptation of Crops to Soils.** — In making choice of the crops to be raised the advice is often given to select only those that are adapted to the peculiarities of the soil. This was strongly urged by the ancients as of prime importance, but, with our better knowledge of the relations of plants to the soil, it can hardly be accepted as a reasonable rule in modern farm practice. In the case of wild plants "it is easy to pick out certain plants peculiar to limestone, or sandy, or clay soils, as the case may be, but these are relatively few when compared with the large numbers that seem indifferent to the nature of the soil. Again, observations of this character tend to show that it is the physical nature of the soil, its capacity for holding water and its permeability to roots, that are, in most cases, of greater importance than its more strictly chemical composition. While there is great difference of opinion as to the relative influence of various soils on plants all are agreed that, with certain obvious limitations, the majority of plants are 'indifferent' to the chemical and physical nature of the soil."

Professor Hoffman, of Giessen, made some extended investigations on the influence of soils on plants, and, "of 107 species under observation, all, or nearly all, found the most essential requisites of their existence equally well in all of the varieties of soil; so that, other conditions being equal, the nature of the soil was indifferent." With the crops usually grown on the farm this is emphatically true, and most of the apparent exceptions to the rule may be accounted for by the influence of climatic conditions rather than peculiarities of soils. The quality and yield of potatoes is probably more directly affected by soil conditions than is the case with other crops, but even potatoes can be successfully grown on a great variety of soils, when proper drainage is provided for.

One of the advantages of a judicious rotation of crops, under a well-planned system of management, is to bring all ordinary soils into a condition that fits them for the profitable growth of all farm crops. The especial adaptation of light lands to the growth of barley and turnips, and of heavy soils to wheat, formerly had a marked influence on the cultivation of these crops in particular localities in England, but this distinction is not now recognized as of practical importance, as under the improved practice that now prevails barley and turnips are successfully grown on heavy soils, and wheat is grown on the lighter or so-called barley soils.

**Economy of Manures in Rotations.** — Thus far, in discussing crop rotations in relation to soil exhaustion, attention has been almost exclusively directed to the conservation of the constituents of the soil itself; and we now have to notice their effect in securing the utilization of the manures applied to the soil. Some general considerations in regard to the action of different kinds of manure will aid us in getting at the principles involved in their preservation by a systematic rotation of crops.

In the Rothamsted experiments with wheat every year on the same land, "the application of a larger amount of nitrogen (as nitrates or salts of ammonia) than the crop can utilize does not appear to prevent the nitrification of the organic nitrogen of the soil. The stock of nitrogen of the soil itself, therefore, may be reduced, although the annual applica-

tion of nitrogen may be made in excess of the amount of that substance removed in the crop." From this it may be seen, without further illustration, that the indirect influence of manures in promoting plant growth must be considered, in many cases at least, quite as important as the direct supply of nutritive materials to the crop. The metabolism of the soil appears to be increased by certain kinds of manure, and from what follows it will be seen that the residues remaining in the soil may depend largely upon the form in which the manure is applied.

In the experiments on the "mixed herbage of permanent meadow," on the plot to which mixed mineral manures (including potash) were applied every year, "although no nitrogen was supplied, there was a great increase in the amount taken up as compared with the produce without manure, especially by the increased leguminous growth. Upon the whole, without nitrogenous manure the amount of nitrogen taken up under the influence of the purely mineral manure, was one and two-thirds as much as without manure, and nearly three times as much as by applying the same manure to either wheat or barley on arable land. Further, with this greatly increased yield of nitrogen in the produce, without the supply of any by manure, there was found a great reduction in the percentage of nitrogen in the upper layers of the soil, indicating the source whence the nitrogen of the vegetation had been derived."

On the other hand, on the plots to which nitrate of soda was applied every year, "it was in the amounts of mineral matter taken up that the difference in the effects of the ammonia-salts and the nitrate of soda was the most marked. Thus, while over the 18 years the quantities of mineral matter removed in the crops were almost identical without manure and with ammonia-salts, with the nitrate of soda more than one and a half times as much was taken up; and the increase, which amounted to an average of nearly 80 pounds per acre per annum, was more than two and a half times as much as is accounted for by the increased amount of soda taken up, due to the nitrate of soda used. It is remarkable, too, that while the decline in the amount of mineral matter taken up over the second period (of 10 years) compared with the first (of 8 years) was 13.5 per cent. without manure, and 35.3 per cent. with the ammonia-salts, it was only 9.1 per cent. with the nitrate of soda."

Another peculiarity of the action of commercial fertilizers must be noticed which is of practical importance. "In the absence of vegetation, or where the amount supplied is in excess of the requirements of the crop, nitrates and salts of ammonia do not appear to form permanent compounds with the soil, but, on the contrary, are liable to be washed out by the rain, or to be otherwise lost." When the large crops of wheat were grown with nitrates, or salts of ammonia, in considerable excess of what was removed in the crop, there were no indications of a storing up of the surplus to add to the fertility of the soil, and any distinct effect on the second crop was rarely observed.

With barnyard manure the results were quite different, and the tendency was uniformly to an accumulation of the elements of fertility in the soil, which was gradually available for subsequent crops. The nitrogen residue accumulated in the surface soil, where barnyard manure had been applied to wheat, is shown in Table 8. The real significance of the figures presented in this table will be better appreciated by a comparison of the yield of the two plots. The average annual yield of wheat on the barnyard manure plot had been 32 bushels per acre for twenty years, and for the last twelve years 35 bushels; while the unmanured plot yielded 16 bushels per acre for twenty years, and 15 bushels per acre for the last twelve years.

In Table 9 has been given, from the experiments in permanent meadow at Rothamsted, the nitrogen in pounds per acre, to the depth of 54 inches, on the unmanured plot; and the plot to which barnyard manure had been applied for eight years, and then left unmanured for twelve years. A comparison of the yields of these plots is given in Table 16, in a form

to show the influence of the barnyard manure on the crop while it was applied, and of its residue upon the crops of the succeeding twelve years. The analytical results presented in Table 9 serve to explain the practical results obtained, which are summarized in Table 16:

TABLE 16.

*Average yield of Hay per annum on two plots, at Rothamsted. In pounds per acre.*

| PERIODS | Plot 3. Unmanured. | Plot 2. Barnyard Manure, 8 years, 1856–63. Unmanured, 12 years, 1864–75. | Plot 2 more than Plot 3. |
|---|---|---|---|
| First period, 8 years, 1856–63, . . | 2665 | 4804 | 2139 |
| Second period, 6 years, 1864–9, . | 2699 | 4846 | 2147 |
| Third period, 6 years, 1870–75, . | 1692 | 2517 | 825 |
| Total period, 20 years, 1856–75, | 2383 | 4130 | 1747 |

The average yield of the two plots during the second period is substantially the same as in the eight years of the first period; but on plot 2, barnyard manure had been applied every year of the first period, while it was unmanured the following years. The residue of the barnyard manure during the second period seems to have furnished as much plant food as had been obtained by the crop during the years of its application. In the third period of six years, plot 2 gave nearly as large a yield as the unmanured plot during the first eight years of the experiment. In the second period there were "one or two years" of more than average productiveness, which is indicated by the slightly increased average yield of both plots. In the third period, however, there was "one season of unusual drought, and others of much less than average productiveness," so that the falling off in the yield of both plots must be partly attributed to unfavorable seasons, and the value of the residue of the barnyard manure is therefore probably underrated.

We should not fail to notice in this connection some of the differences in the wheat and barley experiments, as compared with the permanent meadow plots, and the influence of these differences on the utilization of the residue of the barnyard manure. In the wheat and barley experiments the same crop was repeated every year on the same land, and there was a much smaller proportion of the manurial residue utilized than in the permanent meadow, in which the crop included a great variety of species belonging to different genera, and among which there were a number of leguminous species. Moreover, in the Rothamsted experiments, the manures applied were often very much in excess of the requirements of the crop.

In ordinary farm-practice more moderate applications of manure would necessarily be made, and with a good system of crop rotation, in which a variety of crops are grown, there are good reasons for believing that the residues of the manure would be more completely utilized than in the case of the experimental wheat and barley, or even than on the plots of permanent meadow.

Barnyard manure, from the accumulation of its residues in the soil, has many advantages over the commercial manures, where a rotation of crops is practiced, and a variety of crops in orderly succession will be needed to appropriate all of the elements of plant growth as they are gradually and constantly liberated from the stored-up residues in the soil.

Some crops, like turnips and Indian corn, will bear heavy manuring, while others, like wheat and oats, will do better, as a general rule, to follow a highly manured crop than to receive the direct application of the barnyard manure. The object should be to get the land

in high condition, and then to rely upon a variety of crops to appropriate, with the strictest economy, the elements of fertility as fast as they are made available.

**Systems of Rotation.** — In arranging or planning a system of crop rotation, there are certain general principles that must be kept prominently in view, in order to obtain the best results. In deciding upon the crops to be grown, attention should be given to the abundant supply of suitable food for the live stock it is proposed to keep on the farm, as the success of the management will largely depend upon it.

Having decided upon the crops that are best adapted to the climate and the general system of husbandry it is proposed to practice, the orderly arrangement of these crops becomes a matter of importance.

The old rule that no two grain crops should be grown in succession is obsolete, and need not therefore be regarded. The order in which the crops selected are to be grown must be determined by other considerations than differences in their habits of feeding. In a lecture on "The growth of barley for more than thirty years in succession on the same land," Dr. Gilbert remarks that "there is no doubt that, in addition to the soils on which it is most appropriately grown in the ordinary course of rotation, barley may be grown both in full quantity per acre and of good quality, in succession to wheat, on the heavier soils, when the land is clean enough for a second corn crop."

Notwithstanding the assumption that oats are especially exhausting as a crop, in this country the best farmers sow wheat after oats with advantage, and no valid objection can be raised against the practice on clean land, under a good general system of farm management.

One of the first essentials in crop rotations is that the land shall be constantly occupied with a crop. From the preceding discussion of the sources of waste in the elements of fertility in the soil, it must be seen that soils do not get tired and require rest as an animal does; its processes of metabolism are constantly in progress, excepting when checked by a frost, and if the elements of plant food are not appropriated by a crop as they are made available they may be ultimately lost.

**Flemish Farm Practice.** — The farmers on the light soils of Belgium (campine sands), understand the importance of this principle, although they take but little interest in the teachings of science. They have learned by experience that when one crop is harvested another must immediately be sowed, if they are to get remunerative returns from the light lands they cultivate, which do not contain an abundant surplus of the elements of fertility.

The Flemish farmers have no hesitation in growing several grain crops in succession, when there is a variety of crops in rotation, but certain crops are only grown at considerable intervals, as flax, once in five to seven years. Turnips are often grown, as a catch crop, after grain, to keep the land occupied, and the yield is frequently 10 tons per acre.

One of the most interesting features of Flemish farm practice is an application of the principle that one crop does not interfere with the growth of another crop, as in the growing of carrots with a crop of flax or wheat, and the mixture of two grain crops, as wheat and rye. Wheat and rye grown together give a greater aggregate yield than can be obtained by either grain alone. When carrots are grown with flax or wheat the latter are pulled at harvest, to leave the carrots in undisturbed possession of the soil the latter part of the season. Wheat with carrots will yield 24 bushels per acre, and carrots with wheat will yield 8 tons per acre, or, with flax, ten tons. The flax being harvested earlier than the wheat leaves the carrots a longer period by themselves. The object aimed at is to utilize every element of fertility by keeping the land fully occupied with a paying crop, and the success of their practice is the best endorsement of the principle on which it is based.

In American farm practice the importance of this principle of conserving the elements of production cannot be too strongly urged. In the course of a rotation, if an interval occurs between two crops, some catch crop should be introduced, like turnips or rye, to fill up the gap. In the northern and western states rye seems to possess many advantages as a catch crop. It is hardy, and grows late in the fall and starts early in the spring, and it furnishes a seasonable supply of cattle food, particularly on soils that are not injured by the treading of cattle or sheep late in the season. It may likewise be plowed under and utilized as a green manure, if this practice is thought to be advisable.

Provisions must be made for the thorough destruction of weeds, in the course of the rotation, so that the necessity of resorting to the wasteful process of summer fallowing may be avoided.

**Indian Corn in Rotations.**— Indian corn may justly be recognized as the most important crop in American farm practice, from its great feeding value, either as a grain or a forage crop; its extended period of growth that enables it to use the available constituents of the soil throughout nearly the entire season; the value of its residue per acre in the form of manure, when fed out to the stock of the farm; and, what is not the least of its advantages, its especial adaptation to a systematic course of rotation as a cleaning crop. When placed near the beginning of a rotation and properly cultivated, it leaves the land free from weeds, and in good physical condition for the subsequent growth of grain crops, and it should therefore be reckoned as a preëminently valuable crop in the economy of the farm. The catch crops, to which reference has been made, will likewise aid in checking the growth of weeds, through the "struggle for existence" and "survival of the fittest." If a useful crop is covering the soil the weeds will, of course, have less chance to grow.

In arranging a course of rotation care must be taken in fixing the sequence of crops to provide for the thorough preparation of the soil for each crop, without conflicting with the preceding crop. If the soil is kept in good tilth and condition, this can readily be accomplished with the aid of the modern improved implements of tillage, without violating the rule already laid down that the soil should be kept constantly occupied with a growing crop. As an illustration of the interference of one crop with the preparation for another, which should be especially avoided, we may mention the sowing of fall wheat after corn, cured in the stack in the field, as a practice that cannot be defended on the grounds of economy, as the increased labor involved, to say nothing of other unavoidable losses, cannot be offset by any compensating advantages.

**What is the Best Rotation?**— No specific answer can be given to this question. Every farmer should be able to arrange a system of cropping in accordance with the principles already presented, that will be best suited to the conditions of his farm and the system he proposes to practice, and give him, on the whole, the most profitable results. As a general rule, it will be safe to say that the best rotation, other conditions being equal, is the one that furnishes, in the aggregate, the largest amount of cattle-food and the largest return in manure, provided always that the soil is fully occupied with crops, and the destruction of weeds and thorough tillage are secured.

The farmer who looks upon the applications of science and the results of experiments relating to agriculture as a ready means of settling all questions that may arise in his practice, and who fancies he may be furnished with specific rules or formulæ for every detail of his work, that he can blindly follow without any mental effort of his own, must be disappointed, for his expectations can never be realized.

The wider and more profound the range of knowledge and the more extended the applications of science in every department of his business, the greater the demand for the ex-

ercise of his best powers of thought and judgment, if he is to avail himself of the advantages placed within his reach.

What is most needed in the development of an improved farm practice is a knowledge of the principles or laws of nature that underlie and determine the results obtained, as factors of production, in the various processes the farmer is concerned with in the every-day work of the farm. The intelligent, thinking farmer will then be benefited by bringing every detail of his practice in harmony with them, and he will avoid the losses involved in a routine practice in which they are ignored. The principles of crop rotations are well settled and clearly defined, and they will serve as better guides in practice than any empirical formulæ based on a limited experience under indefinite local conditions.

**Manures.** — A review of some of the leading facts relating to the economy of manures will now be necessary, in order to get clear notions of the principles of a correct practice in their management and application. The problems involved in the supply of manures to the farm cannot be solved by the applications of chemical science alone, as there are many other factors that must receive attention in planning a consistent system of practice.

**Commercial Manures.** — It has been the prevailing fashion, for some time past, to underestimate the advantages of barnyard manure in a general system of husbandry, and to give almost exclusive attention to the commercial fertilizers as a means of keeping up or increasing the productiveness of the soil. From the prominence given to purely chemical considerations, commercial manures have been urged by theoretical writers on agriculture as the only consistent remedies for soil exhaustion, and the manufacturers and dealers in fertilizers are always ready to profit by these unfounded assumptions.

There can be no doubt that large crops may be continuously grown by the exclusive use of chemical manures, and the only question that can arise is as to their economy in ordinary farm practice. If all the farmers in the United States should attempt to rely upon them as a staple manure supply, it must be seen that the price would soon prohibit their use, as the markets of the world could not meet the demand.

They cannot be recommended with reason on the average farms of the country until the barnyard manure has been fully utilized, and even then they can only be used to a limited extent as a supplementary supply for special purposes.

With the prevailing low prices for farm products, the average farmer of the United States cannot afford to buy fertility at the market rates, as he would then place himself at a disadvantage with his competitors in the world's markets. Even in England the question is being raised as to the real economy of the commercial manures they are now using.

**Fertility of Soils.** — In his letters to the *Agricultural Gazette* on "Fertility," Sir John Lawes says: "How are we to explain the benefits of the various operations of agriculture, such as draining, fallows, liming, tillage of all kinds, and the *use of mineral manures*, except by the fact of there being so many means of liberating and utilizing the stock of nitrogen in the soil?

"Many of these operations are said to increase the stock of fertility; and that they do increase the *produce* of the land must be evident to the commonest observation; but it is at the expense of the stock in the soil; and they would be more correctly described as processes for turning to account the existing but dormant elements of fertility contained in the land. The natural fertility existing in the soil is cheaper than imported or purchased fertility, and it would in fact be found more profitable to pay rent for a fertile heavy soil than to farm unfertile heavy land rent free.

"In the district where I live (25 miles from London) the land is cultivated on a five-course shift, and the crops which are grown and sold from the land would cost more to pro-

duce by the means of purchased artificial manures than the sum which the tenant, under the above system of cultivation, pays for them in the rent; or, in other words, as far as regards the production of the crop the land-owner sells his fertility cheaper than the manufacturer of manure could supply it."

In referring to the competition the British farmer has to meet in the importation of grain and animal products from the United States, the distinguished writer says: "It is not, however, the corn grown in the United States by purchased fertility, or even by the manures made upon the farm, that the British farmer need fear as likely to compete with him. The danger lies in the vast stores of unused fertility which constitutes the main wealth of the United States; and this fertility, as I have already pointed out, is very much cheaper than any derived from artificial or imported sources."

The truth of these statements, by one who has devoted his life and fortune to agricultural investigations, and is therefore entitled to speak authoritatively in regard to the economics of agriculture, cannot be doubted, and they should not be disregarded by American farmers.

There are, in fact, two prominent advantages that the farmers of the United States have over their competitors in agricultural production that are of paramount importance, and the utmost care should be taken to make the most of both of them. These are, the adaptation of the climate to the growth of that most valuable of the cereals, Indian corn, and the stores of available fertility in the soil; and the advantage arising from these dominant factors in American agriculture must be recognized in every attempt to improve our farm practice.

In this connection attention must again be called to the fact that the sale of the elements of fertility in the grain and animal products of the farm is of far less importance as a factor of diminished productiveness, than the results of bad management in the growing of crops, and the failure to utilize all residues in the form of manure. If soil fertility is the cheapest, and of this there can be no reasonable doubt, it should be fully utilized under a thorough and consistent system, and when the crop residues, as manure, are returned to the soil, without loss, there need be no fear of soil exhaustion under reasonable methods of cultivation.

**Special Manures.** — The rules of the art of agriculture are not arbitrary, and they are to be accepted as but the rational expression of the principles of practice, which should always be in harmony with the well ascertained facts of every department of science. Partial views lead to inconsistency and error, and the entire range of the sciences must be brought to bear on the complex problems that require solution. Theories which have served their purpose as scaffolding in the development of science and become obsolete as the field of investigation and knowledge is widened, should not be accepted as safe guides in practice.

The special manures which have been so widely advertised furnish a good illustration of the correctness of these general statements, and they require more than a passing notice, as the fallacies which led to their manufacture cannot be readily detected by farmers who are not familiar with the progress of scientific discovery in its relations to agriculture. As a matter of course, the objections which have been presented in regard to commercial manures generally, in ordinary farm practice, are equally applicable to the special manures, but there are also other considerations to be taken into the account in deciding upon their probable value in growing specific crops.

Liebig's mineral theory, that in a short time was proved to be fallacious, was evidently the precursor of the later notions that soil exhaustion could be prevented and full crops grown by furnishing to each crop the same amount of potash, phosphoric acid, and nitrogen that the crop removed from the soil. The proper manure for each crop was, therefore,

according to this theory, a mixture of these substances in the same quantity and proportions as they were found to exist in the crop itself.

The fallacy of this assumption may be shown by reference to some of the facts already presented in discussing other topics, but it may be well to examine other experimental data with reference to this subject.

In commenting upon the analyses of certain special fertilizers, made at the Connecticut Experiment Station, Prof. S. W. Johnson says: "An examination of these analyses and those of special fertilizers, made in past years, abundantly justifies the conclusion that on the farms of this State it is quite as rational to use a 'corn manure' on potato land, or a 'potato manure' for the tobacco crop, as any other way. To attempt to construct a fertilizer specially adapted to growing a particular crop on soils which differ so widely in composition, and have been so differently fertilized and tilled as those of Connecticut, is irrational and useless. Objection to these goods only applies to their names, and to the theory on which they are made and on which their special claims rest. As *fertilizers*, they are of good quality. Their higher retail price, compared with that of other superphosphates, is in part justified by the larger amounts of nitrogen and potash which they usually contain."

If special fertilizers cannot be made to suit the soils of Connecticut, for the reasons given, there can be no prospect of their adaptation to the wider variation in soils in the United States.

At Rothamsted an experiment was made to test the effects of the application of a mixture supplying the ash-constituents and the nitrogen of one ton of hay to permanent meadow with results given in the following table.

TABLE 17.

*Average yield of hay obtained with a mixture supplying the ash-constituents and the nitrogen of one ton of hay.*

| | Average per Acre per Annum. | | |
|---|---|---|---|
| | Plot 18. Nitrogen and Ash-Constituents of 1 ton of Hay. Lbs. | Plot 3. Without Manure. Lbs. | Plot 18. More than Plot 3. Lbs. |
| First Period, 5½ years, . . . . . . . . . . | 3908 | 2514 | 1394 |
| Second Period, 5½ years, . . . . . . . . . | 3301 | 1787 | 1514 |
| Total Period, 11 years, . . . . . . . . | 3604 | 2151 | 1453 |

The annual increase of crop from this application of manure was less than three-fourths of a ton, on the average, for eleven years, instead of the one ton required by the special manure theory. In commenting on the results of this experiment, Drs. Lawes and Gilbert say, "With regard to the applicability of the principle under the actual conditions of practical agriculture, attention may be called to the following considerations: In the first place, there is no conceivable condition of chemical combination and of distribution within the soil, in which the various constituents could be annually supplied so as to be all annually taken up by growing vegetation, and there is conclusive evidence that in some cases the unrecovered residue is, in greater or less part, lost by drainage; and that, so far as it is not so, it becomes

so locked up or distributed within the soil, that it is — at any rate very slowly, and in some cases perhaps never fully — recovered by subsequent crops.

"In the second place, the principle ignores the difference in the character and capabilities of different soils. Take, by way of illustration, two extremely opposite cases; a light, porous, almost exclusively sandy soil, which itself yields up little or nothing to growing plants, but which may, neverthless, produce good crops under high farming, will probably suffer great loss of manurial constituents by natural drainage; so that if no more were to be supplied than were removed, there must obviously be a decline of fertility. Suppose, on the other hand, a rich and deep loam, which would, under good mechanical cultivation and drainage, supply annually a considerable amount of potash, for example, to say nothing of other constituents. for hundreds and perhaps thousands of years, — surely, in such a case, it is not necessary to supply as much in manure as has been removed in the crops.

"Further, experience teaches that, in the actual condition of our soils and of agricultural practice, the exact composition of the crops we remove, or wish to grow, is no direct guide to the description and the amount of manurial constituents which will be the most effective. Thus, an average crop of wheat will remove even rather more phosphoric acid than an average crop of barley; but experience teaches that in the case of land of the same description and in the same condition, superphosphate of lime is, as a rule, used with very much more benefit to the spring-sown barley than to the autumn-sown wheat. The wheat, being put in four or five months earlier, has so much more time for root distribution and acquires a greater capability of food collection. The barley, on the other hand, depends very much more upon the stores available within the surface soil. Again, superphosphate of lime is, in practice, of very special benefit to the so-called 'root-crops,' though the amount of phosphoric acid they take up, compared with other crops, would not indicate this. Then, turning from the mineral or ash-constituents to the nitrogen, an average crop of beans will contain from two to three, and one of clover hay from three to four or more times as much nitrogen as one of wheat or barley; but land in such condition as to grow a full crop of the rich-in-nitrogen beans or clover, without nitrogenous manure, would not grow a full crop of wheat or barley, containing so much less nitrogen, without liberal nitrogenous manuring.

"It is, then, under the existing conditions of practical agriculture, certainly not necessary to supply to the land all the constituents that have been removed from it, or that would be contained in the crops it is wished to grow, and neither more nor less of them than would be so removed. On the contrary, we should supply all, or only some, and more or less, according to the circumstances."

**Manures not all Recovered in the Crop.** — In relation to the action of the special manures, it should be noted that when manures have been applied to the soil in experiments, under conditions to determine the extent to which they are made available by the crop, it is found that a large proportion of the manure is not recovered in the crop to which it is applied, and in many cases the deficiency cannot be accounted for in the accumulated residue stored up in the soil.

In the experiments at Rothamsted, the nitrogen supplied in the manure was considerably in excess of the amount removed in the crop (see Table 2), and only in the case of the barnyard manure and rape cake, containing a large proportion of organic matter, was there evidence to show that any considerable amount of this excess of nitrogen was stored up in the soil.

In the experiments with wheat, a summary of the results obtained on the barnyard manure plot are given in the following table.

TABLE 18.

*Estimated* NITROGEN *supplied in the manure, recovered in the wheat crop, and stored up in the soil to the depth of 27 inches.*

| | Nitrogen of Manure. | |
|---|---|---|
| | Per acre. Lbs. | Per cent. |
| Supplied in barnyard manure in 22 years, | 4415 | |
| Recovered as increase of crops, | 470 | 10.7 |
| Not recovered in increase of crops, | 3945 | 89.3 |
| Residue in soil 27 inches deep, | 2172 | 49.2 |
| Not recovered in crop or in soil, | 1773 | 40.1 |

The residue of the manure accumulated in the soil is very much in excess of the amount recovered in the increase of the crop, and there still remains 40.1 per cent. of the nitrogen of the manure unaccounted for in the crop and the soil residue. With barley continuously grown on the same land there was also evidence of a considerable amount of the nitrogen of the barnyard manure unaccounted for in the crop and soil residue.

Where barnyard manure was applied to permanent meadow land a similar result was obtained, but the deficiency was not as large as in the case of the wheat and barley. With the latter crops the land was bare the latter part of the summer, and the loss of nitrogen would consequently be larger.

TABLE 19.

*Estimated* NITROGEN *supplied in the manure, recovered in the increase of the hay crop, and determined as residue in the soil to the depth of 27 inches, in permanent meadow land.*

| | Nitrogen of Manure. | |
|---|---|---|
| | Per acre. Lbs. | Per cent. |
| Supplied in barnyard manure in 8 years, | 1606 | |
| Recovered in increase in 20 years over the unmanured plot, | 291 | 18.1 |
| Not recovered in increase of crop, | 1315 | 81.9 |
| Residue in soil 27 inches deep, | 911 | 56.7 |
| Not recovered in increase of crop, or in soil, | 404 | 25.2 |

In both cases (Tables 18 and 19) a considerable portion of the nitrogen not accounted for was probably lost by conversion into free nitrogen and escaped into the atmosphere, and part was lost by drainage.

When commercial manures were applied to wheat grown continuously on the same land from 14.4 to 30.1 per cent. of the nitrogen of the manure, according to the amount and condition in which it was applied, was recovered in the crop, but there was a much greater loss by drainage, and a decidedly smaller residue accumulated in the soil. In regard to the residue of nitrogen in the soil of the experimental wheat plots to which commercial

manures were applied every year, Sir John Lawes and Dr. Gilbert say, "Upon the whole, it is obvious that the relative excess of nitrogen in the soil of the different plots is little, if at all, due to the direct retention by the soil of the nitrogen of the manure, but is almost exclusively dependent on the difference in the amount of the residues of the crops — of the stubble, and roots, and perhaps of weeds."

In comparing the relative effects of the barnyard and the chemical manures they reach the conclusion that "a given weight of nitrogen, in the form of nitric acid (nitrates) will produce more growth in the crop to which it is applied than the same weight of nitrogen in dung; but the influence of the nitrate upon succeeding crops will be very much less. There is no evidence to show whether the whole available effect of the nitrogen in one manure is greater than it is in the other."

On the barnyard manure plot of permanent meadow there was recovered in the increase of the crop, in the course of twenty years, 48 per cent. of the potash, and 33 per cent. of the phosphoric acid supplied in the manure during the first eight years of the experiment.

In ordinary farm practice, where a variety of crops are grown in rotation, and manure in less liberal quantity is applied, a larger proportion of the potash, phosphoric acid, and nitrogen would be recovered in the succession of crops than was obtained in the Rothamsted experiments with heavy manuring and the continuous growth of the same crop.

When we consider, however, in connection with the other facts presented, that under the most favorable conditions, with the commercial manures applied to wheat, less than one-third of the nitrogen of the manure was recovered in the increase of the crop to which they were applied the absurdity of the claims made for the special manures must be evident.

**Composition of Crop Influenced more by Season than Manure.** — Plants, as we have seen, are endowed with powers of selection that enables them to obtain their food in sufficient quantity from a great variety of soils. We find, however, that the composition of the mature plant does not vary as much as might be expected under widely different conditions of food supply, and that it is more influenced by season than by the manure. In the experiments at Rothamsted, samples of all crops, grown under a great variety of conditions, were preserved for analysis. A summary of the ash analyses of wheat and barley grown on certain selected plots, representing widely different conditions of manure supply, are given in the following tables.

The potash and phosphoric acid of the ash are alone given, but from the manurial standpoint they are the most important of the ash constituents, and they constitute from 80 to 85 per cent. of the ash of the grain. These plots are selected for comparison from the decided contrast presented in the manure supply:

TABLE 20.

*Highest, lowest, and mean amounts of Potash and Phosphoric Acid, per 1,000 dry substance of Wheat, Grain and Straw, for 16 years.*

| Plots. | Manures. | Per 1,000 Dry Substance of Grain. | | | | | Per 1,000 Dry Substance of Straw. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Highest. | | Lowest. | | Mean of 16 years. | Highest. | | Lowest. | | Mean of 16 years. |
| | | | | | POTASH. | | | | | | |
| 2 | Barnyard manure, | (1853) | 7.79 | (1852) | 5.38 | 6.35 | (1861) | 18.37 | (1852) | 9.06 | 11.91 |
| 3 | Unmanured, . . | (1853) | 8.38 | (1852) | 6.01 | 6.62 | (1861) | 14.16 | (1856) | 6.96 | 9.30 |
| 10*a* | Ammonia-salts alone, | (1860) | 7.38 | (1852) | 5.15 | 6.02 | (1861) | 13.24 | (1859) | 5.69 | 8.71 |
| | | | | | PHOSPHORIC ACID. | | | | | | |
| 2 | Barnyard manure. | (1859) | 11.10 | (1863) | 9.65 | 10.44 | (1853) | 4.12 | (1854) | 1.49 | 2.45 |
| 3 | Unmanured, . . | (1853) | 10.75 | (1849) | 8.98 | 10.03 | (1853) | 3.74 | (1854) | 1 65 | 2.42 |
| 10*a* | Ammonia-salts alone, | (1848) | 10.03 | (1863) | 7.18 | 8.54 | (1860) | 3.47 | (1863) | 0.93 | 1.63 |

The mean amount of potash and phosphoric acid in the grain during the sixteen years, varies but little under the different conditions of manure supply. A comparison of the highest and lowest amounts of these constituents on each plot, shows a wider range of variation, which must be attributed to the influence of the seasons, and consequent relative differences in the maturity of the crops. Under conditions that favor the full development and perfect maturity of the crops the grain varies but slightly in composition.

With the straw the mean amounts of potash and phosphoric acid for the sixteen years, on the different plots. show a somewhat wider range of variation than is the case with the grain, but this is undoubtedly owing, to some extent at least, to differences in the maturity of the crops, and it, therefore, may be attributed to the season rather than to the manure supply. As in the case of the grain, a comparison of the highest amounts of these constituents on each plot shows the dominant influence of the season in the composition of the straw over that produced by the manures. The wider range of variation in the composition of the straw as compared with the grain is readily accounted for by differences in the maturity of the crop. Under conditions favoring the perfect development and maturity of the crop, the grain takes from the straw the elements required for its full development, and the amount remaining in the straw is therefore diminished; but if the grain does not fully mature, as is the case in unfavorable seasons, the straw then retains the elements that have not been appropriated by the grain. In seasons when there has been a luxuriant straw growth, and the conditions for ripening the grain are not favorable, the composition of the straw should be quite different from that of a season of deficient luxuriance in the growth of straw, followed by favorable conditions for the ripening of the grain.

It will be seen from the table that the highest proportion of potash in the grain was in 1853, on plots 2 and 3, and in 1860, on plot 10*a*; and the lowest amount of potash was found in 1852, on all of the plots. In the straw the potash was highest on all of the plots in 1861, but the lowest amount was found in 1852, on plot 2, in 1856, on plot 3, and in 1859, on plot 10*a*. Similar variations will be noticed in regard to the phosphoric acid.

From Dr. Gilbert's lecture on the growth of barley, we copy a table showing the influence of season on the composition of the crop, for comparison with that already given of wheat.

TABLE 21.

*Highest, lowest, and mean amounts of Potash and Phosphoric Acid, per 1,000 dry substance, in Barley grown continuously on the same land.*

| Manures. | Per 1,000 Dry Grain. | | | | | Per 1,000 Dry Straw. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Highest. | | Lowest. | | Mean. | Highest. | | Lowest. | | Mean |
| **POTASH.** | | | | | | | | | | |
| Unmanured, . . . . . . . . . | (1871) | 7.66 | (1853) | 6.00 | 6.54 | (1871) | 11.77 | (1856) | 5.25 | 8.55 |
| Barnyard manure, . . . . . . | (1871) | 8.36 | (1856) | 5.89 | 6.81 | (1871) | 22.01 | (1856) | 6.76 | 13.23 |
| Mineral manure and ammonia-salts, . | (1871) | 7.98 | (1852) | 5.62 | 6.61 | (1871) | 22.53 | (1852) | 5.67 | 14.05 |
| **PHOSPHORIC ACID.** | | | | | | | | | | |
| Unmanured, . . . . . . . | (1852) | 10.08 | (1854) | 8.85 | 9.27 | (1856) | 2.60 | (1863) | 1.20 | 1.74 |
| Barnyard manure, . . . . . | (1871) | 10.50 | (1854) | 9.23 | 9.99 | (1856) | 2.92 | (1863) | 1.48 | 2.19 |
| Mineral manure and ammonia-salts, . | (1856) | 10.39 | (1863) | 8 84 | 9.58 | (1856) | 3.12 | (1863) | 1.06 | 1.94 |

We find here, as in wheat, a greater variation, both in the potash and phosphoric acid, in 1,000 parts of dry substance of grain in different seasons than with different manures. "The seasons showing the highest amount of potash are those of much higher maturing character than those with the lowest amounts."

"Next it is seen that there is still greater, indeed enormous variation, in the amount of potash in the dry substance of the straw, with the same manure, in different seasons. There is also great variation according to manure; comparatively little when there was full supply, but considerable without manure," where there was evidently a deficiency of potash in the soil. "Turning now to the phosphoric acid in the grain, there is here again much more variation in different seasons with the same manure, than with different manures. But while in the case of potash there is the *higher* proportion in the *better* seasons, in that of phosphoric acid there are *lower* amounts in the dry substance in the *better* seasons. In fact, high amount of potash in the ash, and in the dry substance of the grain, is, as a rule, associated with high maturation, that is, with high proportion of starch, while high proportion of phosphoric acid is generally associated with low maturation, and high proportion of nitrogen. The proportion of phosphoric acid in the straw also varies more with season than manure, and it is the highest in the worst seasons."

Grains mature with greater certainty in the more intense climate of the United States, and, as a rule, the composition here depends more on the variety grown than on the season.

**Barnyard Manure.** — A rational explanation of the various processes we are carrying on in the every-day work of the farm must be of material assistance in planning correct and consistent methods of practice. It is the mission of science, as has been already stated in the preceding articles, to explain the results of experience and to point out the direction in which our practice may be improved, and in the management of the manures of the farm its teachings are of great practical importance.

From the facts that have thus far been presented, it must be evident that barnyard manure must be the main source of fertility that the average farmer can profitably make use of to maintain and increase the productiveness of his soil. We have seen that it has important advantages over the commercial or chemical manures, in retaining water near the surface soil, where it is available in time of droughts; in preventing loss of fertilizing elements by drainage; and in the accumulation of its residues in the surface soil, and thus increasing the productive capital of the farm. We have likewise pointed out the important fact that crops feed upon the constituents of the soil even when abundantly supplied with the elements required for their growth in the form of manure, and that the manurial elements supplied to the soil are not all accounted for in the crops produced.

In conserving the elements of fertility the importance of a rotation of a variety of crops of different feeding habits and requirements has already been discussed, and we now need to consider how the barnyard manure can be utilized to the best advantage to keep up or increase the productiveness of the soil.

In converting the field crops of the farm into animal products, a residue remains which we call barnyard manure. For a satisfactory consideration of this residue in all of its bearings, it will be well, on the start, to review some of the leading facts of biological science in regard to the mutual relations of plants and animals, and their processes of nutrition.

From 69 to 92 per cent. of the constituents of plants, and from 35 to 65 per cent. of animals, is water, and the remaining materials are grouped under the general term dry substance.

When the dry substance of a plant, for example, is burned, a large proportion of the elements of which it is composed escape as gas, and only $1\frac{1}{2}$ to 7 per cent. remain in the form of ash. Of the materials burned away, about one-half is carbon, from $2\frac{1}{2}$ to 3 per cent. is nitrogen, and the remainder is oxygen and hydrogen, with a small proportion of sulphur.

The ash is made up of eight elements, *viz.:* potash, phosphorus, lime, magnesium, iron, sodium, silicon, and chlorine. The three elements, carbon, oxygen, and hydrogen, form a very large proportion of the dry substance of both plants and animals, and the remaining ten elements are represented in correspondingly small quantities.

In the first place let us examine the sources from which plants derive the elements of which they are composed.

From the atmosphere they obtain, through their leaves, all of their carbon, which constitutes about one-half of their dry substance, and possibly a small proportion of nitrogen and water, which practically we need not consider. From the soil they obtain all of their ash constituents, and, practically, all of their nitrogen and water. So far as the farmer is concerned in supplying the wants of plants, the nitrogen and ash constituents derived from the soil are the only ones that require attention, and the atmospheric supplies of nutritive materials can be almost entirely ignored. Now, barnyard manure contains all of the elements that plants derive from the soil, and, moreover, its organic constituents have an influence in improving the mechanical texture of soils, so that its real value is not represented by the amount of plant food it contains. As most soils furnish abundant supplies of lime, magnesium, iron, sodium, silicon, and chlorine, these elements have come to be looked upon as unessential constituents of manures, and, although useful, they are not taken into account in estimating manurial values, while the three elements, nitrogen, potash, and phosphorus in the form of phosphoric acid, which are more likely to be deficient in soils, are recognized as the important or essential constituents of manures.

It is therefore generally assumed that the amount of nitrogen, potash, and phosphoric acid in a manure represent its real value, and, as these are commercial commodities, a definite money value can be placed on a manure when the amount of these elements has been determined.

How, then, can the amount of these valuable constituents of barnyard manure be most conveniently ascertained? To answer this question we must return to the known facts of biological science in regard to the relation of plants and animals. Animals have the same elements in their composition that are found in plants, and they also depend on plants for their food supply. Animals, however, obtain a large proportion of their oxygen from the air, and all other constituents are obtained from the plants on which they feed, or, in the case of carnivorous species, from other animals that have fed on plants.

It has been found by direct experiment that animals cannot utilize all of the nitrogen, potash, and phosphoric acid, to say nothing of other elements, contained in the plants on which they feed. With fattening animals only from 5 to 8, or, possibly, under special conditions, 10 per cent. of the nitrogen contained in the food consumed, and from $1\frac{1}{2}$ to 2 per cent. of the potash and phosphoric acid, are stored up by the animal as increase, and the balance is discharged in the solid and liquid excreta which constitute the manure.

Store stock, making no gain, would of course return all of the food constituents in the manure. Cows giving milk, and young growing stock, would retain rather more than fattening animals, and their manure would, to that extent, be less valuable. Pigs retain more of these elements than sheep, and sheep retain rather more than cattle, but these differences depend, to some extent, on the character of the food consumed by the different classes of stock.

It will then be seen that there is a double round of circulation between plants and animals of the elements required in their nutritive processes. Plants obtain their carbon from the carbonic acid of the air, and animals, in their breath, return their surplus carbon to the air in the form of carbonic acid, and each aids the other in the supplies of this most important element, carbon.

Plants, on the other hand, obtain their nitrogen, potash, and phosphoric acid directly from the soil, and animals return to the soil, in their solid and liquid excreta, a very large proportion of these elements contained in their food, and thus a second round of circulation is maintained.

**Barnyard Manure the Circulating Capital of the Farm.**—The constituents of barnyard manure may, in fact, be looked upon as the floating or circulating capital of the farm, and it must be kept in active circulation in order to secure the best returns that can be obtained from it. Success in farm management, with the prevailing low prices of farm products, will largely depend upon the efficient use that is made of this important element of production.

The value of barnyard manure must therefore largely depend on the amount of nitrogen, potash, and phosphoric acid contained in the food consumed by the live stock of the farm. Some qualifications of this statement may be suggested, but from a practical standpoint they may be safely neglected. For example, if the food contains a large proportion of nitrogen, a smaller percentage of it will be utilized by the animal, and a larger percentage would appear in the manure; and if, on the other hand, the food contains a less proportion of nitrogen, a larger percentage would be utilized, and less would appear in the manure. That is to say, the animal needs but a limited supply of nitrogen, and it can obtain it from ordinary foods containing a moderate amount, and it will not take more, even if the supply is excessive. In valuing the manure from the composition of the foods consumed, the tendency would therefore be to underrate the value of the manure from highly nitrogenous foods, and to place it too high when the foods are poor in nitrogen.

The quality of the food consumed has a greater influence on the value of the manure than the kind of animals that produce it. For convenience in estimating the approximate and relative value of the manure produced from different foods I have made the following table, which is based on the average composition of the different articles as shown by the published analyses of American products and the commercial value of the three essential elements of fertility in the form of commercial fertilizers. An allowance has been made for the amount of these elements retained by the average stock of the farm, and the relative value of the manure obtained from the feeding of one ton of the different articles named will be found sufficiently accurate for all practical purposes, as compared with the price of commercial manures in the markets.

TABLE 22.

*Value of Manures produced from 1 Ton of Feed.*

| KIND OF FEED. | Value of Manure from 1 ton of Feed. | KIND OF FEED. | Value of Manure from 1 ton of Feed. |
|---|---|---|---|
| Indian corn, | $6.20 | Potatoes, | $1.68 |
| Corn stalks, | 4.10 | Carrots, | 0.87 |
| Oats, | 6.62 | Swedes, | 1.10 |
| Oat straw, | 3.00 | Mangrels, | 1.43 |
| Wheat, | 7.24 | Fodder corn (green), | 1.10 |
| Wheat straw, | 2.26 | Clover hay, | 9.50 |
| Rye, | 6.70 | Timothy hay, | 6.25 |
| Rye straw, | 2.60 | Brewer's grains (fresh), | 3.60 |
| Barley, | 7.49 | Brewer's grains (kiln-dried), | 12.80 |
| Barley straw, | 2.75 | Malt sprouts, | 16.50 |
| Peas, | 13.50 | Linseed meal (old process), | 20.00 |
| Pea straw, | 5.00 | Linseed meal (new process), | 22.00 |
| Beans, | 15.00 | Cotton seed meal, | 28.50 |
| Bean straw, | 6.00 | Middlings, | 8.90 |
| Buckwheat, | 6.88 | Shorts, | 10.64 |
| Buckwheat straw, | 5.00 | Wheat bran, | 12.50 |

The relation of the rotation of crops to the manure supply of the farm will be readily seen from a careful examination of the table. A yield of 50 bushels of corn, when fed with the stalks, would give about $18.00 as the value of the manure from feeding one acre. An

acre of clover of two tons would be worth as manure, when fed out, $19.00, to say nothing of the roots in the soil, which are worth nearly as much. An acre of timothy, yielding one ton of hay, would be worth but $6.25 as manure.

When the yield of the crop is known, the value of the manure produced by feeding it to stock may be readily estimated.

The crops giving the largest return in manures should have a proportionate influence in keeping up the productiveness of the soil, provided always that the manure is properly cared for and used. Manures cannot be fairly valued by bulk or the number of loads produced, as manure from feeding straw is worth but little, while that from feeding clover hay, or the more concentrated foods, like linseed or cottonseed meals, would be valuable.

The table furnishes suggestions in regard to the means of increasing the manure supply of the farm. In the first place, increased attention to the crops in rotation giving the largest return in manure per acre, would materially aid in this direction. There is, however, a limit to this, as crops of the highest manurial value, like clover, may be liable to fail when grown too often in rotation. Indian corn, however, gives a high yield in manure, and it does not fail from frequent repetition if the soil is kept in high condition.

The second means of increasing the manure supply would be the purchase of foods like cottonseed meal, linseed meal, malt sprouts, etc., and this should be made more economical than the purchase of commercial manures. As these concentrated foods differ but little, if any, in feeding value (we have seen that animals utilize but a small proportion of the nitrogen and ash-constituents they contain), when the price differs considerably in the market the manurial value should be taken into account in determining the choice that is made. A few years ago, a farmer near New York, who had a dairy and small fruit farm, told me that corn meal and cottonseed meal were to be had in the city at about the same price per ton, and he wanted to know which he had better buy to feed his cows. He was looking altogether at the nutritive value, and had not thought of the importance of their comparative manurial value, but when this was pointed out he had no hesitation in regard to the choice to be made.

The foods of high manurial value may be fed to advantage to supplement the coarser fodder of the farm, like straw and the inferior grasses, and this is frequently an inducement to purchase them, aside from the fertility they bring to the farm. The average farmer will find the purchased foods of high manurial value a cheaper source of fertility than the chemical manures that are so commonly recommended. In the feeding of animals for any purpose, the value of the manure produced should always be taken into account in estimating the general results of the process. The profits of feeding cannot be determined by a comparison of the market price of the feed consumed and the price obtained for the animal product, as the future productiveness of the farm must largely depend on the supply of barnyard manure produced under the system of management. It is a short-sighted policy that looks at the immediate results that may be obtained in dollars and cents, at the sacrifice of the circulating capital of the farm, and the means of future production. In the farming of the future, all factors of production must be utilized, if American farmers are to retain the advantages they now have in competition with other countries.

**Root Residues.**— In connection with the manurial value of the crops of the farm, we should not fail to notice the importance of the root residues of crops as a source of fertility. This subject has been neglected by experimenters, and I do not know of any recent exhaustive researches relating to it. Several years ago, Dr. Weiske of Proskau, Prussia, "measured off certain plots of land several yards in dimensions, and carefully excavated the soil to the depth of ten inches, and with extreme pains dug out all the roots he could get in that depth

of soil." The results of his investigations are given in the following table, from a lecture by Professor S. W. Johnson of the Connecticut Board of Agriculture.

TABLE 23.

*Composition of* ROOTS AND STUBBLE, *in pounds per acre.*

| CROPS. | Dry Substance. | Nitrogen. | Lime. | Magnesia. | Potash. | Soda. | Sulphuric Acid. | Phosphoric Acid. |
|---|---|---|---|---|---|---|---|---|
| Rye, . . | 3400 | 62 | 69 | 14 | 30 | 40 | 12 | 24 |
| Barley, . | 1515 | 22 | 40 | 5 | 9 | 3 | 5 | 11 |
| Oats, . . | 2200 | 25 | 81 | 12 | 24 | 17 | 8 | 28 |
| Wheat, . | 2240 | 22 | 72 | 10 | 17 | 11 | 7 | 11 |
| Red Clover, | 6580 | 180 | 246 | 46 | 77 | 19 | 24 | 71 |
| Buckwheat, | 1630 | 45 | 75 | 7 | 9 | 4 | 6 | 10 |
| Peas, . . | 2400 | 53 | 68 | 11 | 11 | 7 | 9 | 14 |
| Lupine, . | 2800 | 58 | 76 | 12 | 16 | 3 | 7 | 13 |

Unfortunately the yield of these crops above ground is not stated, but the figures as they stand are nevertheless suggestive. These root residues are of value not only from the amount of plant food they contain, but for their ameliorating influence on the mechanical condition of the soil, and in the process of decomposition which they undergo in common with the residues of barnyard manure they promote soil metabolism and the liberation of plant food that might not otherwise be available.

**Management of Barnyard Manure.**—The best methods of managing barnyard manure may be readily understood, as they are but the practical application of a few general principles. Although other constituents have, as we have seen, a more or less direct influence on the growth of crops, we need only keep in view the nitrogen, potash, and phosphoric acid, as they are the materials of dominant interest in the preservation of the manure.

In the first place it may be well to ascertain in what form these elements are found in fresh barnyard manure, and the changes they are liable to undergo before the manure is hauled to the field. The sources of waste will then be apparent and the appropriate remedies suggested.

In fresh barnyard manure the nitrogen is mostly in organic combination; there is comparatively a small amount in the soluble form, and very little in the form of ammonia. The mere trace of volatile ammonia, if any is present, is practically not worth notice. Of the potash and phosphoric acid a large proportion is insoluble, but the soluble portions are valuable and liable to loss by drainage. There are in fact no volatile constituents of importance to escape in the gaseous form. From the condition in which the essential elements of fertility are found in fresh dung, it is evident that the only danger of loss arises from the leaching out of the liquids of the manure with the soluble matters that are present. Waste then can only occur through the agency of water percolating through the mass.

**Fermented Barnyard Manure.**—The changes taking place in these elements of fertility when the manure passes through the process of fermentation or decomposition may now be considered. Fermentation consists in the disintegration of the organic matters by various species of microbes that feed upon them and bring about a rearrangement of the constituents of which they are composed. The putrefactive microbes are concerned in what is usually recognized as decomposition or decay. Other species seem to perform a specific role in the work of disintegration. The "microbe of nitrification" leaves as a residue nitric acid, and the "ammoniacal ferment of urine" liberates ammonia, and both are active in the decomposition of nitrogenous organic substances. The entire series of changes taking place

in fermenting manure are the result of the activity of various living organisms through the exercise of their processes of nutrition.

The sum of the effects produced in these processes of decomposition is to increase the solubility of the elements of fertility. Nitrogen takes the form of ammonia below the surface, to a considerable extent, where the micro-organisms are most active, but it is fixed before reaching the surface by entering into combination with ulmic and other organic acids, forming soluble (not volatile) salts. In the large number of tests with litmus paper which I have made the escape of even minute traces of ammonia from fermenting piles of manure has rarely been detected. It is true that gases of pungent and offensive odors are escaping in considerable quantity from fermenting manure, but these consist in the main of carbonic acid, oxide of carbon, etc., all of which are of no manurial value. As in fresh manure, the escape of nitrogen as volatile ammonia is insignificant. There is possibly a small loss of phosphorus as phosphoretted hydrogen, but this may practically be neglected. The loss of valuable plant food in fermenting manure must then be attributed to the increased solubility of the constituents of manurial value and their transportation through the agency of water. If water is not allowed to percolate through the manure the loss of valuable constituents will be reduced to a minimum, and this must be the leading point to which attention is directed in efforts to prevent the waste of manures. By keeping the manure in flat compact masses, with plenty of litter, through which water is not allowed to filter, there can be no loss of valuable volatile constituents, and the soluble materials will be perfectly preserved.

If the manure is in high, loose piles, the liquids, with the soluble matters, will leach downwards, and the top of the pile is robbed of these elements of value, while the escape of the liquids at the base of the pile will involve serious loss. The importance of an abundant supply of litter to absorb all liquids will be readily suggested from the consideration of the real sources of probable loss. The litter should be in sufficient quantity to absorb and hold the liquids, so that the manure can be handled and hauled to the field without any waste of soluble matters. Manures supersaturated with water cannot be handled under any ordinary methods of management, without wasting, to a great extent, its most valuable constituents. On farms where heavy expenditures were annually made for commercial fertilizers, I have seen the manure carts dripping with liquids on the way to the field, and distributing the essential elements of value along the lanes and highway. Such violations of the principles of economy in other business would result in financial disaster, and from such examples of careless practice, one can hardly avoid the conclusion that farming must pay better than other industries, or it could not be carried on with such lavish wastes of the elements of production.

If straw is used for litter in stables or yards, it may be "chaffed" by running through a cutting machine, with great advantage, as its absorbent powers are increased, and the manure is more conveniently handled.

**Absorbents of Volatile Matters.** — From the principles laid down in regard to the causes of waste in manures, it will be seen that absorbents of volatile constituents are not needed to preserve plant food, although they may be advantageously used for removing offensive odors from stables. When lime and gypsum are used in stables as absorbents of gases, many persons are impressed with the idea that all is being done that can with reason be required, to preserve fertilizing materials, while the important source of loss, the escape of liquids, is entirely overlooked and neglected.

The real effect of the absorbents in common use for purifying the air of stables is seldom understood, and they are often presumed to do what they cannot, under the circumstances, accomplish. Lime may destroy unpleasant odors, but it will tend to liberate ammonia from less stable combinations, while, on the other hand, sulphuric acid may fix

ammonia, but at the same time it will decidedly increase offensive odors. The sense of smell is not, therefore, a test that can be relied on in detecting the escape of valuable manurial elements.

Gypsum, when dry, does not prevent the escape of ammonia, and it is only in the presence of water that ammonia is fixed by it in a soluble and non-volatile form.

Lime and gypsum in small quantities are of use in promoting nitrification, as a salifiable base is needed to combine with the nitric acid, as it is liberated by microbes. This is a probable explanation of the marked effect of lime and gypsum when applied to the soil in small quantities, and of the known influence of gypsum on the growth of clover. From the large amount of nitrogen taken up by clover, any aid to nitrification must be beneficial. The effects of lime and gypsum, when applied to the soil, are desirable, but when applied to manure they may promote changes that increase the solubility of the elements of fertility, and the consequent dangers of waste.

**Box Stalls.** — The manure that is allowed to accumulate in box stalls, compacted by the treading of animals, is in the most favorable condition for its preservation, as an abundance of litter must be used to keep the animals dry, and, moreover, it is under cover, and protected from the influence of rain.

**Manure Cellars.** — As usually managed manure cellars are a most unsatisfactory arrangement for preserving manures, and, fortunately, in the interests of economy, they appear to be going out of fashion.

**Open Yards.** — On a large proportion of the farms of this country manure is kept in open yards, and the waste of fertility under ordinary conditions is enormous. It is important, however, to know that if sufficient care is taken to prevent the loss of soluble constituents by leaching, the manure may be preserved, in this way, with a minimum of waste, until hauled to the field. To secure this result, the bottom of the yard should be slightly concave, and made water tight to prevent any possible loss by drainage. An abundance of litter must be used to absorb all liquids, and the water from the roofs of buildings must not be allowed to enter the yard. The manure should be kept uniformly level, so that it will be compacted by the animals tramping over it.

With these precautions to secure a flat, compact mass, through which water is not allowed to percolate, drainage being fully guarded against, the rain that may fall directly on the manure is not a serious evil, as at first sight might be suggested, as evaporation is constantly going on, and the litter of the yard should be sufficient to absorb, for the time being, all ordinary rains. The evaporation from the surface of the manure has an important influence in keeping the yard dry. In 1865 Dr. R. C. Kedzee, at the Michigan Agricultural College, made observations on the rainfall and evaporation, from March 15 to November 14, with the following results: Total rainfall for the period, 24.35 inches; evaporation from a water surface, 30.85 inches; or evaporation in excess of rainfall for the eight months, 6.50 inches. The evaporation may not be as great from the surface of the manure in the yard, but the experiment seems to indicate that a large proportion of the rainfall on the surface of the manure may be removed by evaporation, and that, with proper precautions, to prevent drainage, the waste of the manure from the water falling on it need not be feared. The larger the amount of rainfall, the greater, as a matter of course, will be the difficulty of preventing loss from drainage; but, as this is the sole source of loss to be guarded against, success in preserving manure in open yards will depend upon the complete prevention of waste in this direction.

In ordinary farm practice the forking over or composting of barnyard manure before hauling to the field cannot be commended, as it involves an expenditure of labor, with some

loss of fertility, without any compensating advantages. The valuable elements of the manure are made more soluble by composting, and they are therefore more immediately available for the use of plants, but the dangers of loss by drainage are increased.

When the manure is applied under a definite system to crops in rotation, the preparation of the manure by composting is not only unnecessary, but, on the whole, it is better to have the fermentation of the manure take place in contact with the soil itself, as it increases soil metabolism, and therefore aids in the disintegration of the root residues of crops, and the full benefit of the manure can thus be realized. The mutual reactions of fermenting materials in the soil are undoubtedly of considerable importance.

**Application of Manures.** — Barnyard manure should be hauled to the field as soon as convenient after it is made, and spread at once on the surface. The too common practice of leaving the manure in small piles in the field for several days, or even weeks, before spreading, is open to many objections. Under such conditions fermentation is actively carried on, and the elements of fertility are made more soluble. A fall of rain leaches the piles, and the soil beneath them receives an excess of fertility, at the expense of the surrounding area where the leached manure is afterwards spread. A uniform distribution of the manure over the field should be secured as far as practicable, and this can only be done by spreading the manure as it is hauled.

Many farmers haul the manure directly from the stable to the field, without depositing or storing it in the barnyard, and the practice has many advantages that are commendable. There is, in the first place, a direct saving in the labor of handling, and, when the stables are constructed with wide doors, so that a cart or wagon can be driven through in rear of the stalls, this method of cleaning stables will be convenient and economize labor, and the manure, when loaded, can be driven at once to the field. If the field to which the manure is applied in the winter is reasonably level, so that there is no danger of the manure being washed off by heavy spring rains, it may be spread over a considerable body of snow without loss. The claim, in fact, is often made that the manure spread on the snow gives the best results, but this need not be urged in defense of the practice on the score of economy.

The hauling of manure when the labor involved can most conveniently be spared, is certainly an advantage, and, on the whole, there is less waste of manure, under ordinary conditions, than when it is allowed to accumulate, and the work of hauling is all done at a time when other work is pressing.

If the principles which have been presented in regard to the care and management of barnyard manure are intelligently applied, the details of management may be readily adjusted to the system of practice in each particular case, and the enormous waste of the elements of production that are now so common will be avoided.

The essential conditions for the preservation and application of barnyard manure may be briefly summarized as follows:

1st. Provide water tight floors and manure gutters in the stable, and use sufficient litter to completely absorb all liquids.

2d. Keep the manure in flat, compact masses, through which water is not allowed to percolate, and thus avoid all loss by drainage; or, haul directly to the field from the stable as fast as the manure is made.

3d. Under any conditions of management haul to the field as soon as convenient, to economize labor, and spread at once on the surface.

4th. If the manure is plowed under, a shallow furrow is desirable, as it should be kept near the surface soil as far as practicable.

5th. When manure is spread upon the surface of the soil there is no danger of loss from the escape of volatile matters of manurial value, and the plowing under of the

manure may be looked upon as simply a matter of convenience in the cultivation of the crop.

**Composts.**—The directions for making composts are of comparatively little interest in ordinary farm practice, as, for reasons already given, it will not pay to compost barnyard manure. In market gardening, however, or when several crops are grown in the year on the same land, and large quantities of manure are used, the immediate action of the manure is of importance and composting must be resorted to.

One of the advantages claimed for the composting of manures on the farm, is the destruction of the seeds of weeds in the manure. This can hardly be admitted as a legitimate defense of the practice, as under good management weeds should not be allowed to mature their seeds, as they can be kept in check with a less outlay of labor in the early stages of their growth.

As a general rule the materials that can be composted with advantage on the farm are of low manurial values, and an expenditure of labor may readily be made on them in excess of their real value as manure. If these limitations of the profits that may be derived from the process are kept in view, a compost heap may be managed with some little advantage, to work up, or dispose of, such coarse materials as are not suitable for cattle food or litter, or for immediate application to the soil as manure. The compost heap must be looked upon as a means of utilizing comparatively unimportant wastes, that may, in itself, become a considerable source of loss if it receives too prominent a share of attention.

**Green Manuring.**—The plowing under of a green crop undoubtedly adds to the stores of plant food, and improves the mechanical condition of soils, but the cases in which the practice can be defended on grounds of economy are exceptional, as they do not often occur in ordinary farming. On worn out, or on very light soils, that are not in condition for remunerative cropping, green manuring may be resorted to on the start as an ameliorating process to bring them into better condition, but even then the fertility gained is at the expense of materials that should have a value for other purposes, and the advantage derived from the practice cannot therefore be estimated as a net gain.

Green manuring was formerly recommended on heavy lands to improve the mechanical texture of the soil, and with the same purpose in view, it has likewise been urged as a desirable means of adding to light soils the organic substances in which they are deficient. But as this improvement in the texture or mechanical condition of both heavy and light soils can, under proper management, be brought about by other means, that are, on the whole, quite as efficient and less expensive, this argument in favor of green-manuring ceases to be pertinent, or of any considerable practical importance. The draining of heavy lands, and the accumulated root residues of crops on all soils, together with the supply of barnyard manure, in connection with thorough tillage, are the most available and legitimate means of improving the mechanical texture or condition of soils.

On average farms that are returning even a moderate yield of crops, the systematic practice of green manuring must be looked upon as a wasteful process, that has no adequate compensating advantages that can be urged in its favor.

In discussing the subject of barnyard manures, attention was called to the fact, that animals retained but a small proportion of the elements contained in their food that are recognized as of manurial value, and that there was but little difference in the value of a given substance for manure in its original condition and after it had been consumed by animals.

The application of this principle, which has been fully established by direct experiment, in studying the economy of green manuring must be obvious. When the crop is fed to

animals two prices, in effect, may be realized; first, the return received in the animal product, and in the second place the return of nearly its original value in manure. The sum of the two prices should certainly exceed in value that obtained from one of them alone. If a crop is plowed under, its manurial value can only be considered, and there is an actual loss of its feeding value, which might be realized without materially diminishing its efficiency as manure.

But there are other considerations that must have weight in deciding upon the advisability and economy of green manuring. The biological factors in farm economy are exceedingly complex, and the indications that lie upon the surface do not always represent the real facts of practical significance. Formulated rules of practice, based upon superficial and apparently obvious relations, are often misleading when all of the factors that can influence the results are not carefully ascertained and their relative importance determined.

Paradoxical as it may appear, there is evidence which seems to indicate that the removal of a crop from the land may prove to be a better preparation for the subsequent crop than if it had been plowed under in the earlier stages of its growth. In the circulation of the floating capital of the farm, to which reference has been made, it is not a matter of indifference where a switch is put in to give a new direction to the moving elements of profitable production. They must be allowed to expend the total sum of their energies in every step of their progress, or the full benefits that may be derived from them cannot be realized.

It is not so much the amount of matter in circulation that must be considered, as the facilities for its complete transfer from one stage to another in the round it must pursue in making its circuit. A moderate amount of capital in active circulation, without any check or hindrance, may be much better than a larger investment that is allowed to stagnate in eddies that result from obstructions to its course. When once diverted from the direction in which they can act efficiently their immediate influence is lost, and these elements of fertility may not, for a long time, be again made available in contributing to the profits of the farm.

**Clover and Wheat.** — Some experiments made by Dr. Augustus Voelcker, with reference to clover as a preparatory crop for wheat, furnish a good illustration of the practical value of these suggestions. English farmers expressed the opinion that land where "clover had been grown for seed in the preceding year, yields a better crop of wheat than it does when the clover is mown twice for hay, or even only once and afterwards fed off by sheep." Aside from the well-known fact that a good crop of clover was an excellent preparation for the following wheat crop, "it has further been noticed that clover mown twice leaves the land in a better condition, as regards its wheat producing capabilities, than when mown once only for hay, and the second crop fed off on the land by sheep; for, notwithstanding that in the latter instance the fertilizing elements in the clover crop are in part returned in the sheep excrements, yet, contrary to expectation, this partial restoration of the elements of fertility to the land has not the effect of producing more or better wheat in the following year than is reaped on land from which the whole clover crop has been carried, and to which no manure whatever has been applied."

According to the generally accepted notions of soil exhaustion at that time, the growing of a crop of clover seed was considered more exhausting to the soil than the mowing of the crop at an earlier period of its growth for hay, and the latter was thought to be much more exhausting than the feeding off of the crop with sheep; that is to say, the amount of soil exhaustion was measured by what was removed in the crop. From this apparent conflict of the teachings of experience with what was thought to be a satisfactory explanation of what had been recognized as soil exhaustion, Dr. Voelcker was led to make the experiments to which reference has been made.

A field that had not previously been very productive was seeded to clover, and the first crop was cut for hay. On part of the field the second crop was likewise mown for hay, while on the other part of the field it was allowed to remain until the seed was matured. Samples of the soil and of the clover roots were carefully taken from both parts of the field, and analyzed with the following results, as estimated in pounds per acre, from the samples examined.

On that part of the field where both crops were cut for hay, the dry clover roots weighed 1,493 pounds, and they were estimated to contain 24.5 pounds of nitrogen. Where the clover seed was grown, the dry clover roots weighed 3,622 pounds per acre, containing 51.5 pounds of nitrogen. There was not only this larger amount of nitrogen in the increased root development in the part of the field where clover seed was grown, but there was also very much more nitrogen in the soil itself. The perfect maturity of the crop seemed to be necessary to enable it to fully perform its work of accumulating nitrogen in the surface soil.

When the second crop was grazed by sheep, or cut in proper season for hay, it was disposed of in an immature condition, and the ameliorating influences of the mature crop could not be realized. In fact, it appeared that "the larger the amounts of nitrogen, potash, soda, lime, phosphoric acid, etc., which are removed from the land in a clover crop, the better it is, nevertheless, made thereby for producing in the succeeding year an abundant crop of wheat."

In plowing under a crop of clover as green manure, in an immature condition of its development, as is usually the case, is it not well to consider that it might be allowed to mature its seed and the crop be saved without in any way diminishing its value in increasing the productiveness of the soil?

**Climate and Crop Rotations.** — Climate must have a decided influence on systems of crop rotations in the United States, under such a wide range of climatic conditions as to temperature and moisture, but the required data are lacking for a full discussion of the subject, from the general inattention to what may be called a consistent system of farming in a large proportion of the States.

In connection with the climatic data we now have, from the extended system of signal service stations throughout the country, there is need of a more complete history of the farm practice of different localities, and a more intimate knowledge of the results that have been obtained under different methods of management. We may predict with some degree of exactness, that certain crops will succeed or fail under particular climatic conditions, but we have not the required facts in regard to the results and relative profit of the various routine systems of cropping, in our widely different climates.

The general principles of farm practice are equally applicable in all localities, but the details of management, including the rotation of crops, must be adapted in each case to the climatic conditions that prevail. In Great Britain the systematic adaptations of farm practice to climatic conditions are well established, and although they may not be applicable in this country, they are of interest as showing the importance of adjusting the details of management to prevailing conditions of climate.

Some of the most important features of the climate of Great Britain that have an influence on agriculture may be briefly noticed as follows: In the eastern counties of England and Scotland the average annual rainfall is from 20 to 25 inches, with a mean summer temperature of 61°, and a winter mean of 38° to 39°. In the western counties, and in Ireland, the annual rainfall varies from 34 to 60 inches, and the mean temperature is about 57° in summer and 41° in winter.

With these differences in rainfall and temperature, there are more cloudy days in the west, which has a decided influence on the ripening of wheat. In the eastern counties of

England it is stated that of the grain grown 43 per cent. is wheat, 25 per cent. barley, and 20 per cent. oats; while in the west of England, and in Ireland, of the grain grown, the proportions are, 78 per cent. oats, 7 per cent. barley, and only 14 per cent. wheat. In fact it is only in favored localities in the west of England that wheat or barley can be profitably grown.

It is claimed that a mean summer temperature of 60° is required in England for the successful growing of wheat, and the clearer skies of the eastern counties are required for ripening it.

In 1816, 1853, 1860, and 1879 a very low yield of wheat was obtained, and the seasons of these years were characterized by a lower summer temperature (56° to 59° for July and August), an increased rainfall, and greater number of cloudy days. The Rothamsted experiments show that, under the climatic conditions that prevail there, the highest quality of grain is produced in the hottest summers, and the least amount of straw in the dryest seasons. The lowest weight per bushel and the greatest amount of straw correspond with the lowest summer heat and the greatest number of rainy days.

In a valuable paper on "Our Climate and our Wheat Crops," by Drs. Lawes and Gilbert, it is said: "It has been remarked, that so far as climate is concerned, the British Isles are outside the zone favorable to the growth of wheat, and that its successful cultivation is due to the skill of the farmer in contending with adverse meteorological conditions. It is true that the area under the crop is rapidly diminishing, and that its continued growth appears to gravitate to those districts where the climate, or the soil, or the combination of the two, is most favorable."

A good illustration of the changes in practice required by slight differences in climatic or other conditions, is Marshall's statement that on the Cotswold hills "a stone might be thrown from the country which sows its wheat in August into that which sows its wheat in December," the harvest in both cases being in August.

Turnips grow best in the moist climate of the west of England, but they are grown more largely in the eastern counties, where they are found more profitable than where the larger crops can be grown. From the higher winter temperature in the western counties turnips do not keep as well, as they tend to run to seed when a temperature above 40° prevails during the winter months, and as the greater rainfall of the autumn prevents the feeding of the crop on the land, and interferes with harvesting it, they are not found to be a profitable crop, and the grasses largely take their place in crop rotations. In Scotland mangrels do not do as well as turnips, while in England, in the vicinity of London, thirty tons of beets are grown as readily as twenty tons of turnips.

The adaptation of crops and systems of rotation to the wide range of climatic conditions in the United States can only be outlined in general terms, as the necessary facts for a detailed discussion are wanting. The present signal service is doing good work, which should be extended, as it is laying the foundation for a systematic study of climatic influences in relation to agriculture; and intelligent, observing farmers throughout the country are acquiring a mass of facts in their experience that will be of great value in developing consistent systems of practice in each locality. At present we can only point out to American farmers those fundamental principles of agriculture that are of universal application, and when these are generally recognized and acted upon we may reasonably expect to find in each locality an adjustment of the details of practice to the climatic conditions under a consistent and rational system of management.

Professor William H. Brewer, of Yale University, has made the best and most comprehensive collection of facts that are now available in regard to climate in its relations to agriculture, in his "Report on the Cereal Production of the United States," in the volume of statistics of agriculture, forming part of the U. S. Census Report for 1880.

This is the first systematic attempt to collate the climatic conditions of production with reference to the distribution of crops throughout the country, and to trace their influence on the agriculture of each locality. As this voluminous report is not accessible to farmers generally, a summary of some of the most important facts recorded will be of especial interest.

The Department of Agriculture at Washington publishes from year to year statistics of agriculture based on estimates of its various correspondents which are of value from a commercial point of view, but the factors of most immediate practical importance to the farmer in the management of his farm are almost altogether neglected. When the Department of Agriculture is organized on a permanent basis, and entirely removed from the influence of party politics, it may be made of real assistance to the farmer and become an efficient factor in promoting the true interests of agriculture.

**The Cereals.** — As of the first importance in American agriculture the six leading cereals of the country will be noticed in connection with the data presented in the census report of 1880, and, for comparison, the statistics of the Department of Agriculture for 1887 and 1888 as the only ones available of later date.

According to the Department of Agriculture Reports, the annual value of the cereals has increased from $987,857,142 in 1879 to $1,284,477,973 in 1888, and the aggregate annual yield averaged 48 bushels per head of population in the period since 1879, and in the preceding period of ten years, 42 bushels per capita.

There is no country in the world where the cereals are so abundantly produced, or where they are so lavishly used and wasted. In the Department Report for 1888, it is stated that the "aggregate product of cereals" in the United States is greater "than has ever before been recorded," amounting to 3,200,000,000 bushels, or about 51 bushels per head of population. "This is about three times the average supply per capita of Europe from home production, which is supplemented by receipts from other continents, amounting to only about one bushel per head. So nearly is Europe self-supporting; so liberal are the supplies of the United States; so hopeless is the expectation greatly to enlarge permanently our volume of exports."

In the following table will be found the area in acres of each of the six cereals, and the total yield of each crop for the years 1879 (Census Report 1880), and 1888 or 1887 (Department of Agriculture Report 1888), together with the percentage of each crop to the total area of cereals, and the product in bushels per head for the total population.

TABLE 24.

*Statistics of* CEREAL PRODUCTION *in the United States for 1879 and 1888, or 1887.*

| Crops. | Acres. | Bushels. | Per cent. of all Lands in Cereals. | Bushels per Head of Population. |
|---|---|---|---|---|
| Corn, 1879, | 62,368,504 | 1,754,861,535 | 52.6 | 35 |
| " 1888, | 75,672,763 | 1,987,790,000 | 51.9 | |
| Wheat, 1879, | 35,430,333 | 459,483,137 | 29.7 | 9.2 |
| " 1888, | 37,336,138 | 415,868,000 | 25.6 | |
| Oats, 1879, | 16,144,593 | 407,858,999 | 13.6 | 7.8 |
| " 1888, | 26,998,282 | 701,735,000 | 18.5 | |
| Barley, 1879, | 1,997,727 | 43,997,495 | 1.6 | 0.84 |
| " 1887, | 2,901,953 | 56,812,000 | 2.0 | |
| Rye, 1879, | 1,842,233 | 19,831,595 | 1.5 | 0.38 |
| " 1887, | | | | |
| Buckwheat, 1879, | 848,389 | 11,817,327 | 0.7 | 0.24 |
| " 1887, | 910,500 | 10,844,000 | 0.6 | |

The relative proportions of the crops grown in the two years designated, as shown in next the last column of the table, is nearly the same, and may be taken as an indication of the average farmer's judgment in regard to their relative value. Corn holds substantially the same position, and it is undoubtedly recognized as, on the whole, the most valuable crop. With wheat, however, there is a falling off in the percentage column, although there is an actual increase in area of nearly 2,000,000 acres; while oats have not only increased in actual area, but also in their percentage proportion of the cereals.

The greater variation in oats, it should be remarked, is partly owing to increased cultivation in some of the newer western States, as, for example, in 1879 Dakota is credited with 78,226 acres, and a yield of 2,217,132 bushels, while in 1888 the area grown is estimated at 1,258,008 acres, with a yield of 34,218,000 bushels.

There have been some changes in the order of the States, arranged according to production of the different crops, as follows:

With *Corn* in 1879, the first six States in production were (1) Illinois, (2) Iowa, (3) Missouri, (4) Indiana, (5) Ohio, (6) Kansas, producing 64.75 per cent. of the total crop. In 1888 the order is (1) Iowa, (2) Illinois, (3) Missouri, (4) Kansas, (5) Nebraska, (6) Indiana, producing 59.70 per cent. of the total crop. In this list Ohio drops to the seventh place. There is a falling off in acreage in Illinois and Indiana, but an increase in all the other corn growing States.

With *Wheat* in 1879, the order was (1) Illinois, (2) Indiana, (3) Ohio, (4) Michigan, (5) Minnesota, (6) Iowa, producing 53.46 per cent. of the total crop, while in 1888 we have (1) Dakota, (2) Illinois, (3) Indiana, (4) Ohio, (5) California, (6) Minnesota, producing 44.61 per cent. of the total crop. In 1879 California was seventh and Dakota twenty-second on the list, and in 1888 Iowa drops to seventh and Michigan to eighth place. In rather more than one-half of the States there is an increased acreage and production, and in the others a decrease.

With *Oats* in 1879 the order was (1) Illinois, (2) Iowa, (3) New York, (4) Pennsylvania, (5) Wisconsin, (6) Ohio, producing 60.5 per cent. of the total crop. In 1888 the order is (1) Illinois, (2) Iowa, (3) Minnesota, (4) Wisconsin, (5) Kansas, (6) New York, producing 53.3 per cent of the total crop. In 1879 Minnesota was seventh and Kansas eleventh, and in 1888 Pennsylvania recedes to seventh place. There is an increased acreage of oats in every State in 1888, and increased production also, with a single exception.

A comparison of the acreage and average yield per acre, in two periods of nine and ten years respectively, is given in the following table.

TABLE 25.

*Statistics of the* CEREALS *of the United States in two periods; 1880—1888, and the preceding ten years*

| Crops. | Average Annual Area in Acres. | | Average Yield per Acre in Bushels. | | Average Annual Value of Crop per Acre. | | |
|---|---|---|---|---|---|---|---|
| | 1880 to 1888. | 1870 to 1879. | 1880 to 1888. | 1870 to 1879. | 1880 to 1888. | 1870 to 1879. | Difference. |
| Corn, | 69,679,436 | 43,741,331 | 23.8 | 27.1 | $9.71 | $11.54 | $1.83 |
| Wheat, | 37,185,307 | 25,187,414 | 12.0 | 12.4 | 10.09 | 13.00 | 2.91 |
| Oats, | 21,389,049 | 11,076,822 | 26.5 | 28.4 | 8.50 | 10.03 | 1.53 |
| Rye, | 2,094,500 | 1,305,061 | 11.9 | 14.1 | 7.43 | 9.92 | 2.49 |
| Barley, | 2,419,380 | 1,529,357 | 21.8 | 22.0 | 12.82 | 16.27 | 3.45 |
| Buckwheat, | 872,287 | 551,104 | 12.8 | 17.7 | 8.23 | 12.65 | 4.42 |
| All cereals, | 132,170,783 | 83,391,089 | | | | | |

The average annual area in crops over a period of several years furnishes a better standard of comparison than the area in single years, and the progress of the country as a whole is well shown in the columns giving the area of each crop for the period designated. A fifty per cent. increase in the acreage of corn and wheat, and the area of oats nearly doubled, in ten years, is an indication of prosperity that is quite satisfactory. This is likewise shown by the increase in the average annual value of the aggregate of the cereals in the last period, which amounts to $296,620,831.

When we examine the columns giving the average yield per acre for the two periods another view of the case will be suggested. Here is evidence of a decided falling off in the yield of all crops in the last period when compared with the first. To what is this to be attributed? Are our soils wearing out at the rate indicated by this diminished yield? Is this, in fact, an evidence of soil exhaustion? My answer to the last two questions is emphatically, no.

The decline in yield, in my opinion, must be attributed to the combined influence of unfavorable seasons and errors in farm management, and the latter is undoubtedly the most important factor, and it is also the one that can be fully remedied. From the increased area of the cereals on the newer uncropped soils of the west, a higher average yield might with reason have been expected, under average conditions of seasons. If this inference is correct the table understates the real decline in yield for the period.

Fluctuations in seasons cannot be controlled or prevented by the farmer, but he can, by better methods of management, reduce their unfavorable influence to a minimum. The effects of drought or of excessive rainfall are not noticed to the same extent on well cultivated and thoroughly drained soils as they are on land that is carelessly managed.

The last two columns of the table, in which a comparison of the average annual value of the crops per acre is made for the two periods deserve careful attention. A considerable part of the decrease in value of the crops per acre in the last period was caused by the lower prices of farm products, and the remainder by diminished yield. It is evident, that with low prices, it is a matter of the first importance to keep up the yield of crops per acre, so that the loss from the unavoidable shrinkage in price may not be increased by a diminished quantity of crop.

The annual loss to the farmers of the country from the diminished yield of the last period, as compared with the first, must be over $147,578,000, which could have been nearly all saved under a better system of farm practice. But this is not all: the average yields of the cereals in the preceding period were altogether too low, as the best farmers throughout the country were securing very much better results. With mixed husbandry, and the utilization of manures derived from the crops fed on the farm, and a fairly good system of crop rotations, these annual losses from decreased yields would disappear or be materially diminished.

**The Cereals and Animal Products.**—The relation of the cereals, or crop growing generally, to animal husbandry, and more especially meat production, is rapidly increasing in importance. But a few years ago the exportation of fresh meat, or of live butcher's stock, was practically almost unknown. In 1870 the total value of all living animals exported from the United States was but $1,045,039, while in 1880 the aggregate value was $15,882,120.

In 1888, the animals and animal products exported were valued at $109,882,948, while the exports of bread and breadstuffs had an aggregate value of $127,191,687. In the interests of an improved agriculture, the exportation of the surplus produce of the farm in the form of animal products must be looked upon with favor.

It is readily seen that success in the manufacture of animal products must depend upon the successful cultivation of the cereals in connection with other crops; but that, in the long

run, the profitable cultivation of the cereals must depend upon the use made of the live stock of the farm, is not, to the mass of farmers, as obvious.

Several years ago, from a study of a statistical map of Michigan, I called attention to the fact, that the counties reporting the largest yield of wheat per acre had a larger number of live stock to each one hundred acres of improved land than the counties with a smaller yield; but this is only equivalent to saying that the counties producing the most manure have the largest crops.

Professor Brewer in his valuable report on the cereals, makes the following sensible statement: "The relations of grain growing to the production of live stock in the United States present some interesting features. In most modern civilized countries the aims of agriculture are about evenly divided between the production of crops and the production of domestic animals. In the most highly developed agriculture, and under the most enlightened civilization, these two go together on the same farm. These two departments of agriculture are dependent upon each other, and are mutually helpful, each stimulates and increases the production of the other; but with a lower scale of civilization, and in a ruder state of agriculture, they may be entirely separated, and in such cases are always antagonistic.

"Writers in the last century, and in the very early part of this, regret that in the United States horse power is used so exclusively on farms in the place of oxen, it being claimed that oxen were the most economical. This preference for horse-power, however, led to the use of lighter machinery and greater rapidity in the performance of farming operations. Thirty years ago numerous writers expressed the belief that the extension of railroads would be detrimental to horse production in the agricultural regions of the United States. It is, however, an interesting fact, that with the introduction of railroads has come an increase in horse production. The diminution of the use of horses in staging has been much more than met by their increased use on the farm, and for the transportation that is incidental to railroads.

"By the production of animals on grain farms, a greater variety of crops may be grown with profit, and there is a better utilization of waste material. In the older States the straw forms an important element of forage for the production of beef and wool. The unmarketable portion of the grain crop, the soft corn, the screenings from other grains, are utilized in the production of animal products. This is so evident that it is only under the most favorable circumstances that the grain-grower can afford to throw away the refuse and rely for his profits merely upon the grain produced; and intimately related to the last is the production of manure on the farm.

"This assumes especial importance in a variety of ways. Grain growing cannot be carried on indefinitely without manuring except under those rare conditions when the land receives a supply of fertilizing elements from water, either by artificial irrigation, or by natural overflows. The agriculture of any country, to be permanently prosperous, is practically founded on its system of manuring.

"The difference between the continued fertility and increasing production of the countries of Northern Europe, of England, of Holland, of Belgium, and similar countries where much live-stock is grown, and the exhausted fertility of the countries lying about the Mediterranean is due to the difference in the methods of farming and manuring. In the one case, animals are grown, and the manure which they produce has tended to keep up the fertility of the soil; in the other, which is essentially an agriculture without domestic animals, hand tillage taking the place of animal tillage so far as possible, crops are carried from the soil, and regions that once produced their hundred-fold now scarcely produce five-fold. The competition with the new Western States, with their rich virgin soils, however severe, cannot and does not entirely kill grain-growing in the less favored regions of the

East, largely because of the greater proportion in which the grain refuse is utilized in the East by feeding and the use of the manures so produced.

"American grain production, especially that of corn, is intimately related to meat production, and this phase of the question, although very old, is just now attracting renewed and very great attention. As early as the middle of the last century, and probably earlier, it was the custom to feed animals on corn in New York and the New England States, and ship them to the West India Islands. But it is only since the modern methods of transportation of live and dead meat have been devised, that American animal production has assumed the enormous commercial importance that it now has.

"The American meat product, and hog product, is most intimately connected with corn production. It is safe to say that 90 per cent. of the hog production of the West is fattened on Indian corn, and pork, lard, beef, etc., are the concentrated product for transportation. The usual movement of grain is eastward, but under particular conditions of the market corn is bought in Chicago in considerable quantities and carried westward for the feeding of stock, even into the great corn-growing districts of that state. One case is known to me of a large feeder, living in the heart of a great corn-growing region, who has found it to his profit to buy corn in large quantities in Chicago, transport it to the western part of Illinois, and re-ship the meat eastward, corn freight westward at the time being very cheap; and I understand that this is by no means an exceptional case. The large meat export to England is intimately connected with this whole question."

When the mass of American farmers adopt a definite system of management, in which the proper relations of the live stock to the field crops are fully recognized and maintained, one of the objectionable features of our farm practice, that was unavoidably developed in pioneer times, will disappear. In the pioneer system of management the immediate results of every operation were alone considered, and the area of each crop was varied from one year to another as the exingencies of the case seemed to demand. It was, in fact, a hand to mouth system, that was constantly changing in accordance with immediate local demands. When any particular product was bringing more than an average price, it received greater attention from every farmer, and, if it was a field crop, an increased area was devoted to it, with the very natural result of over-production and corresponding low prices the following year. If pork is high every farmer rushes into pork-raising, until the results of overproduction lead to the general verdict that "pork don't pay," and the swine industry is neglected and gives place to some other dominant idea, of sheep, or beef, or wheat, or dairy, with the same inevitable outcome of over-production and low prices.

This habit of attempting to adjust production to immediate local demands, which became fixed in the pioneer practice of the country, has been kept up by American farmers since the conditions that gave rise to it have passed away. From the increased facilities for transportation, it is not now the local demand for his products that the average farmer is most concerned with, but the world's supplies, and he cannot adjust his production of any staple to the constantly varying demands for that product in the world's market from year to year. The problem is too large, and involves too many elements with complex relations, to make guesses in regard to probable future demands a guide in practice. Great fluctuations in production and corresponding changes in methods of practice are always to the disadvantage of the farmer in the long run, as it takes a number of years for him to adapt all the details of his practice to the new conditions involved in a radical change in any single interest.

The average diminished value per acre of the cereals in the last ten years, as shown in Table 25, we have attributed to a falling off in yield and the lower prices of the period. We have attempted to show that the first cause assigned is in the farmer's control, and should therefore be remedied, and it remains for us to consider how far the farmer himself is

responsible for the second assigned cause of diminished value, the low prices of his products. It is a law of political economy that supply and demand are the dominant factors in determining the price of commodities. From the widely extended competition in all farm products a return to the high prices of former years cannot with reason be expected, unless under some extraordinary disaster to the crops in a locality that contributes largely to the world's supplies, which cannot of course be foretold for the benefit of other localities.

Under present conditions of production the interests of the farmers throughout the country will, on the whole, be best subserved by pursuing a policy that will not tend to increase the effects of competition by the over-production at any time of any particular commodity. A uniform system of management, in which the field crops and the live stock of the farm are adjusted in due proportions, in quantity and quality, to give the best results, will be found more satisfactory on the score of profit, in the long run, than frequent changes of plans, to conform to fluctuations of markets.

With a variety of crops, in a well-planned system of mixed husbandry, in which, for example, the corn and oats, as the staple grain crops for cattle food, with a proper proportion of forage crops, are adapted to the wants of the live stock, a certain amount of wheat may be grown every year without detriment to the other dominant interests of the farm. Any marked fluctuation in the area of wheat from year to year will tend to disturb the balance of adjustment in other interests without any corresponding advantages, and it should therefore, as a rule, be avoided. From the interdependence of the relations of the field crops to one another and to the live stock of the farm, any radical changes from year to year in the area of a single crop cannot with advantage be made. The leading object of the farmer should be to convert all of the elements of fertility at his command into valuable farm products, and this utilization of raw materials can best be made with a variety of crops, cultivated under a consistent system, and this will, on the whole, enable him to realize the largest possible profit. The seeking of short cuts, or royal roads, to success will end in disappointment.

## INDIAN CORN.

"The area of maize, as estimated for the crop of 1888, makes an increase of 3,280,043 acres over the crop of 1887, and 13,304,259 acres over the census crop of 1879; indicating a gain of 21 per cent. in nine years. The estimate for 1888 is 76,672,763 acres, an area more than three-fourths as large as the combined areas in wheat of all the countries of Europe, and nearly twice as large as the acreage in maize in all the other countries of Europe and America."

Since 1879 the average annual home consumption of corn is estimated at 27 bushels for each unit of population, and for the preceding ten years at 25 bushels. For 1888 the supply "beyond the probable foreign demand," is estimated at 30 bushels per capita.

"The average production for ten years, 1870 to 1879 inclusive, was 1,184,486,954 bushels; of the nine years of the present decade, 1,657,948,726 bushels, an increase of 40 per cent.;" and the increase for home consumption is estimated at 42 per cent., which is "much greater than the increase of population."

The importance of this crop in American agriculture can hardly be overestimated, and yet the seven States of Iowa, Illinois, Missouri, Kansas, Nebraska, Indiana, and Ohio produced 54 per cent. of the crop of the United States in 1879, and 64 per cent. in 1888. It is grown over a wider extent of country than any other crop, and yet American farmers do not seem to fully appreciate its real value in mixed husbandry, particularly in its relations to the growth of other crops in rotation.

The large return per acre obtained from its residue in the form of manure, when fed to stock, its indispensable office as a cleaning crop where roots are not grown, and the large supply of valuable cattle food it furnishes per acre, all point to it as the most important crop in rotation, as upon its thorough cultivation and management the success of the subsequent crops largely depends. Moreover, in rotations it is pre-eminently the crop to which green barnyard manure may be freely applied with advantage, and its residue in the soil, after the crop is removed, becomes available for the crops which are to follow. A heavily-manured corn crop is a good preparation for grain crops, — and it should rank with clover as an ameliorating crop.

**Preparation for the Crop.** — Indian corn does best on a deep, thoroughly tilled soil, and the roller may be advantageously used to give it compactness. Shallow plowing as a preparation for the crop, which appears to be in favor in some localities, is not to be recommended, unless compelled by an absolute deficiency in the depth of soil, or other special considerations.

After plowing, a good seed bed should be secured by the use of the cultivator and harrow. In the application of manure, care should be taken to keep the surface free from coarse litter that may interfere with the subsequent cultivation of the growing crop. If the litter in the manure has been run through a cutting machine, which is to be recommended as a matter of economy in handling and management, the manure may be applied to the surface after plowing, and the cultivator and harrow will then incorporate it with the soil to a sufficient extent. Manure in which long litter has been used will be better plowed under.

**Hills or Drills.** — If the land is reasonably clean, planting in drills will give satisfaction, but on weedy land hill culture is preferable, as it gives a better opportunity for destroying weeds by running the cultivator both ways across the field, and thus diminishes the labor of hand hoeing.

**Cultivation.** — In some of the northern and eastern States, hand hoeing of the crop is practiced to a considerable extent. At the West, however, and especially in the large corn-growing States, hand labor is avoided as far as possible, — and in many localities the hoe is rarely used. Clean cultivation of the crop is, however, essential, if its full benefits in the course of rotation are to be realized.

One of the latest improvements in the cultivation of the crop is the use of the Thomas smoothing harrow in the early stages of its growth. This is a most efficient method of keeping down weeds, if the surface of the soil is reasonably free from obstructions. The smoothing harrow should be used early, as soon as the first weeds make their appearance and before they get firmly rooted in the soil. The process may be repeated at intervals until the corn is several inches high, without detriment to the crop. The smoothing harrow, when judiciously used, will materially diminish the amount of hand hoeing required in the cultivation of the crop. In all farm operations the saving of hand labor cannot be too strongly urged, as a matter of economy, whenever it is practicable, and in the growing of Indian corn it may be largely dispensed with to advantage.

**Yield per Acre.**— The annual yield of the crop per acre, in different seasons and localities, presents some interesting features that should be carefully studied. The average annual yield in the United States, from 1880 to 1888 inclusive, was 23.8 bushels, and the range of variation was from 18.6 bushels in 1881, and 20.1 bushels in 1887, the two lowest years, to 26.5 in 1885, a difference of 7.9 to 6.4 bushels per acre. Taking the lowest figure and the acreage of 1887, this would represent a difference in the aggregate yield of over 463,000,000 bushels.

In the seven northeastern States (New England and New Jersey), where commercial fertilizers are most largely used on the crop, the yield was from 32 to 34.9 bushels per acre in 1885, or an average of 33.2 bushels, and from 30 to 35.5 bushels in 1887, or an average of 33.9 bushels.

In the seven central States (Illinois, Iowa, Missouri, Kansas, Indiana, Nebraska, and Ohio), producing more than one-half of the total crop, the yield was from 31 to 37 bushels in 1885, or an average of 33.6 bushels, and from 19.2 to 26.3 bushels in 1887, or an average of 21.7 bushels.

In the best year, 1885, the average yield is practically the same in the two groups of States, the difference being less than the probable error in the statistics. In the year giving the smaller yield, 1887, the northeastern States had an average of 33.9 bushels per acre, while in the central group of States, where the largest proportion of the surplus of the crop is grown, the average yield is but 21.7 bushels per acre, a falling off of 11.9 bushels from the yield of 1885. This illustrates the advantages of better cultivation, which have already been referred to as a means of counteracting the influence of unfavorable seasons.

There is but little variation in the yield of the good and the bad seasons in the northeastern States, where the crop is more highly manured and better cared for. In the central group of States, on the other hand, where large areas are cultivated, and manures, as a rule, on the larger farms are, to a great extent, or altogether, neglected, in the best year the yield is about the same as in the northeastern States, but in the less favorable season there is a decided falling off in the crop. The influence of a bad season is undoubtedly more severely felt where a careless system of management is practiced.

In both localities, it should be remarked, the average yield of the crop is considerably below what it should be, and very much less than is obtained in the West and East by the best farmers. The farmer who does not obtain an average yield of from forty to fifty bushels per acre of corn should not be satisfied that he is pursuing the best methods of practice.

Even in the northeastern States the full benefits that should be derived from the cultivation of the crop in rotation are not realized, and this may be largely attributed to the too general neglect of barnyard manure and the too exclusive reliance on commercial fertilizers as the staple manure in growing the crop.

The statistics of corn growing in these selected States may, however, without further comment, lead to a false impression in regard to the real conditions of agriculture in the central group of States, as compared with New England.

Of the seven States growing the largest product of corn there are several that are comparatively new, and their large product is obtained from almost virgin soils under a pioneer system of management; while others have passed the pioneer stage and have modified their practice accordingly. I am aware that the claim is often made that the agriculture of New England is far in advance of that in the States further west, but this cannot be admitted by those who are familiar with the farm practice in both sections of the country. While fully recognizing the necessity for adaptations of practice to peculiarities of climate, markets, etc., I am fully satisfied from personal observation, that the best farming, so far as thorough system, attention to manures, and the results obtained in mixed husbandry are concerned, is to be found in the central States east of the Mississippi, and they are all large corn-growing States.

As an illustration of the possible high yields of Indian corn that may be obtained, and the capacity of the crop for heavy manuring, attention is called to some of the results of the competition for a prize of $500 offered by the *American Agriculturist* for the best acre of Indian corn grown in 1889. Of the forty-five competitors for this prize ten were in South

Carolina, the Board of Agriculture of that State having offered to increase the prize by the additional sum of $500, in case the prize crop was grown by a South Carolina farmer.

Mr. Z. J. Drake was the winner of this combined prize of $1,000 for the crop grown on a sandy soil in Marlborough County, S. C., under the following conditions of cultivation: The previous cropping of the acre on which the crop was grown was as follows: In 1885 a poor crop of corn; in 1886, with commercial manures, a crop of about 300 pounds of seed-cotton; and, in 1887, corn at the rate of five bushels per acre. In 1888 manures were applied, consisting of a dressing of leaves, etc., from the neighboring woods, followed by "25 horse loads" of stable manure, 75 bushels of cotton-seed, 500 pounds of manipulated guano, 250 pounds of cotton-seed meal, and 250 pounds of kainit, all of which were plowed under; and the large crop of 917 pounds of lint-cotton was grown.

The manures applied in 1889 for the prize corn crop were as follows:

| | | |
|---|---|---|
| " 1,000 | bushels | stable manure (50 one-horse loads). |
| 867 | pounds | German kainit. |
| 867 | " | cotton-seed meal. |
| 200 | " | acid phosphate. |
| 1,066 | " | manipulated guano. |
| 200 | " | animal bone. |
| 400 | " | nitrate of soda. |
| 600 | " | cotton seed." |

The estimated value of these fertilizers was $226.92, including $7 for labor in applying them, and the other items of labor, etc., including interest on value of the land, chargeable to the crop, were estimated $37.50, making the total cost of the crop $264. The lavish and extravagant supply of manures in the two years must have been very much in excess of any possible requirements of the crop, and involved a great waste of valuable fertilizing materials.

The yield of the one acre was 17,407 pounds of ears as harvested, and this was "estimated," from selected average samples to be equal to 255 bushels of shelled corn as harvested, or 239 bushels when "crib-cured."

In preparing for the crop, in 1889, most of the manure was plowed under, but some of the guano, kainit, cotton-seed meal, acid phosphate, and animal bone, and all of the nitrate of soda, were applied at intervals, between the rows, as the crop was cultivated.

The corn, "a common Gourd variety of the Southern white dent," was planted March 2d in rows, "alternately, 3 and 6 feet apart, — that is, there were six feet betwecen two rows, then three feet, then six feet," etc. One bushel of seed was used, 5 or 6 kernels being dropped in every 12 inches of the row, and on April 8th the plants were thinned to a single one every 5 or 6 inches.

The crop was harvested November 25th in presence of witnesses selected to superintend the harvesting and weighing of the corn, and they certify that the yield "was 17,407 pounds of corn in the ear, of which 140 pounds was soft or poor corn." The acre was surveyed by a "legal surveyor," who testified, under oath, that the area was exactly one acre, and the harvesting committee verified the measurement before the corn was harvested, so that all precautions were taken to secure accuracy in every detail until the corn as husked was weighed.

Thus far the record is satisfactory, but in reducing the 17,407 pounds of corn ears as harvested to dry or merchantable shelled corn, some considerable allowance must be made for possible errors in estimating the shrinkage in drying, which was made from averaging selected samples.

The estimated yield of 239 bushels of shelled crib-cured corn is apparently too high,

but there can be no doubt that the yield was an enormous one and considerably above 200 bushels of merchantable shelled corn. Unfortunately the yield of stalks of this grand crop is not stated.

The value of the crop, at the estimated price of seventy-five cents per bushel of crib-cured shelled corn, would be $179.25, "to which may be added $15 for one and one-half tons of cured top-stalks," which must be a remarkably liberal estimate, making the total value of the crop $194.25. The expenditure of $32.67 more for manures than the total value of the crop at a liberal estimate, and the addition of $37.50 in other expenses, making a total of $70.17 per acre outlay in excess of the value of the crop produced, would evidently not pay in ordinary farm practice.

Of the 45 crops grown in competition for the corn prizes offered by the *American Agriculturist*, the lowest estimated yield was 45 bushels per acre, and eight crops have reported yields of 100 bushels, or over, per acre.

Mr. Alfred Rose of Yates Co., N. Y., is second on the list, with a yield for one acre of 15,898 pounds of corn ears as harvested, which are estimated to be equal to 213 bushels of shelled corn as harvested, or 191 bushels of crib-cured shelled corn, and 25 tons of stalks. The soil, a sandy loam, was evidently in high condition, as it had been in oats the preceding two years with a yield of 93 to 100 bushels per acre, and it "had received ten cords of stable manure each year." Eight hundred pounds of commercial "corn manure" was applied for the corn crop.

The corn was planted May 20th, in rows three feet apart, with two kernels to each foot. The stalks were thinned so that they averaged one every nine inches. The crop was "topped" September 20th, and the ears were harvested November 5th. The total cost of the crop was estimated at $55, and the financial results for the acre are much better than in the case of the first prize crop.

Mr. George Gartner, Pawnee Co., Nebraska, is third on the list with a reported yield of 11,-380 pounds of corn ears as harvested, which are estimated to be equal to 171 bushels of shelled corn as harvested, or 151 bushels shelled "crib-cured" corn. The land was a deep and rich alluvial soil, that had been in corn three years, manured with stable manure, and it had yielded 100 bushels of shelled corn per acre.

For the crop of 1889 thirty or thirty-five cords of "fine well-rotted manure from the yard," was distributed in the furrows as plowing progressed and plowed under. The corn was planted May 12th, in hills three feet apart each way, and "stand averaged four stalks per hill." The land was so situated that it received the waste from the barnyard every spring, which should of course have an influence on the crop.

The cost of the crop was estimated at $49.70, and as corn was worth but twenty cents a bushel in Nebraska the crop evidently did not pay.

These must be considered remarkable yields, even after making proper allowance for an underestimate of the shrinkage in reducing the gross weight of corn ears as harvested, to bushels of merchantable shelled corn, and they are especially interesting as showing the possibilities of the crop under exceptional conditions. The economy of these extraordinary yields will be considered in another place.

It may, however, be remarked, that although these large crops cannot be profitably produced on any considerable scale, there is abundant evidence to show that the average yields of 10 to 35 bushels of corn per acre, in the different States, are very much too low, and that they can be materially increased with profitable results.

**Climate.** — The following statistics in regard to the climatic distribution of Indian corn in the United States are compiled from Professsor Brewer's report on the cereals. "The ideal climate for corn is one with a summer four and a half to seven months long, with-

out frosts, the middle portion hot both day and night, sunny skies, sufficient rains to supply the demands of a rapidly growing and luxuriant crop, falling at such intervals as to best provide sufficient moisture, without ever making the soil actually wet. It is popularly believed that corn grows faster when the nights, as well as the days, are hot, and when the ground is dry as it is possible to be without the leaves curling in the middle of the day."

Less is grown where the *mean annual temperature* is above 75° than where it is below 40°; 40.8 per cent. of the entire crop grows where the average annual temperature is between 45° and 50°; and 87.3 per cent. where it is between 45° and 60°. The crop falls off rapidly below an annual temperature of 45°, and slowly above 50°. The summer temperature and its distribution is more important than the mean annual temperature. "The table of distribution, according to the July temperature, shows that more than half of the crop, or 54.8 per cent., grows where the mean temperature of this month is between 75° and 80°. The regions where these July temperatures prevail, and where the proper distribution of rain comes, lie almost entirely on the Atlantic slope, while corn flourishes under a great range of climate, and, although very sensitive to frosts, a tropical or sub-tropical climate is not very well suited to its growth. There is, however, a region in Southern California, notably in Los Angeles County, where, with irrigation, large crops of corn are produced, and, in some places, even two crops per year, the mean temperature representing a much more tropical climate than exists in the Gulf States, where the crop does not flourish well."

In portions of Los Angeles County corn is grown without irrigation. Most of the corn of California is grown in the southern part of the state; in other parts showers are wanting during the warmer season, and "when the days are hot enough the nights are too cool." Professor Brewer says, "one sees in Southern California what, so far as I know, he sees no where else in the United States — corn in nearly every stage of growth at the same time, from the young plant scarcely up, or less than a finger length high, through to others knee high, others just coming into tassel, others fit to boil, and still others ripe." With other conditions favorable for the crop there must be exemption from late spring and early fall frosts.

**Rainfall.** — "That corn needs abundant moisture is shown by its distribution in regard to rainfall. Sixty-three and four-tenths per cent. of the entire crop is grown where the annual rainfall is between 35 and 45 inches, and 86.8 per cent. where it is between 30 and 50 inches. But one-half per cent. is produced where the rainfall is less than 25 inches, and only two-tenths per cent. where it is less than 20 inches. This in part may be due to other reasons than the absence of moisture in the soil. In regions where the rainfall is slight the air is usually very dry during the growing period, and in a dry atmosphere radiation is greater, and, consequently, the days are hotter and the nights cooler than in a moist climate. Such a condition exists over most of the drier portions of the United States, and notably over all those portions where the dryness and elevation go together; and that is probably one reason why so small a proportion of the crop is produced at elevations above 2,000 feet. The cool nights of such regions are not favorable to a luxuriant growth of corn, no matter how hot and how sunny the days may be. We may have a proper mean temperature and still the crop not flourish."

**Summer Rainfall.** — The mean spring and summer rainfall has a much greater influence on the crop than the annual rainfall. Ninety-eight and seven-tenths per cent. of the crop is grown where the mean spring and summer rainfall is from 15 to 30 inches, and 65.0 per cent. where it is between 20 and 25 inches. "Corn needs the peculiarity of rain and sunny weather coming together. The cooler summers, less sunshine, and more wet weather (not more rainfall, however), of northern Europe furnish the reason why corn does

not flourish so well in climates there with a mean annual temperature like ours, and with an amount of annual rainfall which seems at first favorable to the crop."

**Latitude.** — In the United States 54.8 per cent. of the crop is grown between the parallels of 39° and 42°, and 20.2 per cent. between 40° and 41°. Outside of the first mentioned parallels, as in the case with temperature, the crop falls off slowly to the south and rapidly towards the north.

**Elevation.** — Fifty-four per cent. of the crop is grown between 500 and 1,000 feet above the level of the sea, and 82 per cent. between 500 and 1,500 feet. But 4.4 per cent. is grown above 1,500 feet, and only 12.5 per cent. below 500 feet.

The Ohio drainage basin embraces 22.5 per cent. of the total crop and the Mississippi basin 82.4 per cent.

From these statistics it will be seen that Indian corn is grown under a great variety of climatic conditions, when the temperature of the growing season is high enough to ripen it, and there are no other peculiarities that are incompatible with its development. According to Humbolt it was grown in vast fields on the plateau of Mexico, 8,680 feet above the level of the sea, and in Lima, Peru, it is grown at an elevation of nearly 12,000 feet.

Corn cannot be grown in England as a farm crop on account of the low summer temperature. Some of the small early varieties have, however, been grown there, and in 1850 Mr. Keene raised a crop of "forty-days corn" in St. James Park, London. The seed was obtained from the Pyrenees, and planted May 24th, and the crop fully ripened was harvested October 10th. English farmers seem to appreciate very fully the great advantages American farmers have in growing Indian corn. When discussing the influence of the existing competition in farm products on English agriculture, Sir John Lawes remarked to me that the English farmer would not fear foreign competition if they conld grow that truly American cereal, Indian corn.

**Time of Growth and Ripening.** — Statistics are wanting to show the time of growth and ripening, and the most favorable conditions for its production in the different climates of the United States. As a general rule it may be stated that the time required to mature the crop varies with the length of the season, and the rapidity of the change from winter to summer. At the south, with long summers. and where there is a gradual change from winter up to the temperature required for the ripening of the crop, there is greater luxuriance and a longer period of growth. At the extreme north the summers are short, and the transition from the winter to the summer temperature is more rapid and of greater range, and corn is matured there in from 60 to 90 days. Dent varieties are grown in Michigan that ripen in ninety days after planting.

At the extreme north the whole plant is dwarfed and the stalks are much smaller than at the south, where there is greater luxuriance of growth. In 1876 I made a collection of corn, for the Centennial exposition, from the northern limits of its growth to the Gulf States, and from Kansas to Nova Scotia, that illustrated the peculiarities of its growth under a great variety of climatic conditions. The smallest ear weighed but half an ounce, and the largest one pound, eight and one-half ounces. One of the most notable peculiarities of the collection was the marked difference in the relative proportions of the cob to the grain, which was evidently the result of climatic conditions. At the north, notwithstanding the small growth of stalks, the cob was much larger in proportion to grain than at the south, where there was much greater luxuriance and larger stalks.

**Varieties.** — The number of varieties of Indian corn grown in the United States may reach 150 to 200 according to the best estimates. These are not all, as a matter of course,

equally well defined or established, and there is great confusion in the names applied to the different sorts, even in the same state. Almost every neighborhood has one or more local varieties, that are especially adapted to the locality by peculiarities more or less marked.

In a well-established variety the habits of growth and form of stalk, leaf, and ear become fixed, so that they are retained for a greater or less time when removed to other localities where the climatic conditions are somewhat different. After a time, however, of greater or less extent, according to circumstances, the climatic conditions prevail over the inherited habits of the variety, and a modified form or new variety is produced. The local varieties, to which reference has been made, are modified forms of varieties obtained from other localities, the change resulting from different climatic conditions and selection.

In my collection of corn there were a number of specimens of Flint corn from the South, the seed of which had been originally obtained from the North, that were beginning to show the characteristics of the Dent varieties, and a western Dent that had been grown in Canada for a number of years, was assuming the Flint characteristics.

It is a popular notion that the Flint varieties are earlier than the Dent, and in many localities Flint corn is planted to avoid the dangers of an early fall frost. There are, however, early Dent varieties that, in Michigan, succeed as well as the average Flint sorts. The time of ripening at the South may be hastened by planting varieties from the North, while the Southern sorts will not mature at the North unless the season is exceptionably favorable and there is an unusual exemption from fall frosts. Professor Brewer says: "In time required for maturity, some varieties require six or seven months; others only as many weeks. In height, the ordinary field varieties range from 6 to 12 feet, but there are several garden varieties of less than three feet. There is one that is ordinarily but 20 to 26 inches high, and I have seen perfect specimens, of normal growth, maturing and producing perfect and well-formed ears, that were but 18 inches high. On the other hand, corn was shown at the Centennial Exhibition reputed to be 17 feet high. In California Cuzco corn is cited, in the local agricultural press, at over 19 feet high. Mr. C. L. Flint speaks of a stalk of corn in eastern Tennessee 22 feet high; travelers tell still larger stories. Morelet tells of corn in Central America from 21 to 24 feet high, and John J. Thomas tells of it in the West Indies 30 feet high. But, without considering these greater specimens, varieties are in cultivation in the United States which habitually range from 3 to 16 feet, and in size of ears from 2 to 13 inches; in extreme cases from 1½ to 16 inches in length." The grains vary enormously in size, "the variety of Cuzco corn having only 330 grains per pound, while a variety of popcorn has upwards of 3,600 kernels per pound, the one averaging more than eleven times as heavy as the other."

I have raised corn in Illinois so high that a tall man on horseback had to rise in his stirrups to reach the butt of the ears, and this even was not considered very remarkable. "This marvelous variety of characters illustrates the plastic nature of the species and its wonderful capacity of adaptation to different conditions of cultivation, soil, and climate, new varieties being easily formed, or old ones changed to meet new conditions. Because of this the grain is adapted to more varied conditions of agriculture (particularly as regards methods of cultivation) than any other cereal. At the one extreme no other cereal is so well adapted to the wants of a savage or barbarous people, practicing the rudest arts of cultivation; at the other extreme, no other grain is produced in such enormous quantities as this is in our Western States. The fact has already been alluded to that this grain spreads in cultivation faster among savage peoples than among the enlightened people of the Old World."

"Of all our grains maize is the most variable in character; is cultivated under the most different conditions; is applied to the most varied uses; is cultivated over the widest geographical range (unless possibly barley), and is applicable to the most dissimilar conditions

of agriculture. Although attaining its greatest production in a temperate climate and in a region of cold winters, it is nevertheless essentially a tropical plant, in that it requires a hot summer to mature it; yet it will grow far north, and in a cold climate, so far as annual temperature is concerned, provided we have the one condition of a hot summer, including hot nights, with sufficient moisture and bright sunshine."

**Corn as Fuel.** — To persons not familiar with the varied phases of pioneer life on western farms the use of corn as fuel is looked upon as a wanton destruction of valuable food that is entirely indefensible. In my visits to prairie farms I have often seen corn used for fuel, and, under the circumstances, the practice appeared to be based on motives of strict economy. Professor Brewer, after a careful investigation of the subject, considers corn-ears as fuel equal to good dry hard wood, and in treeless regions, remote from markets and supplies of other fuel, he thinks corn may be the cheapest fuel that can be obtained. According to his estimate 100 bushels of corn-ears would be equivalent in value, as fuel, to one cord of seasoned hard wood. Where corn is worth but ten cents a bushel and coal fifteen dollars a ton it is evidently better economy to burn the corn than to exchange it for coal in a market from fifteen to twenty-five miles distant, and perform the involved labor of hauling both ways over bad roads. With improvements in markets and means of transportation, however, such incidents of pioneer life are soon superseded by what outsiders would recognize as better methods.

From a recent report in the daily press it appears that "a Kansas justice decides that corn is fuel. A thousand bushels of corn belonging to a farmer named Steadman had been attached. Steadman said he was using corn for fuel, and that a thousand bushels was not more than enough to last a year. The justice ruled that under the law exempting a year's fuel the attachment would not hold good."

**Manufactured Products of Corn.** — In looking over the available markets for his surplus produce, the farmer should not lose sight of the various uses of corn in manufactures, and the constantly increasing demand for it in many different ways. Aside from its home value as cattle food, and the large amounts exported for similar purposes abroad, it is growing in importance as the source of a number of manufactured products that are assuming immense proportions.

At the present time nearly all the distilled spirits and all of the alcohol manufactured in the United States are made from corn and its products, and it is also largely used in various forms in the manufacture of malt liquors. The amount of corn disposed of in this way is enormous, but exact statistics of this consumption cannot be obtained for various reasons.

"Corn is the source of nearly all of the starch manufactured in the United States. In other countries laundry starch is made from potatoes, wheat, rice, and a variety of materials, but, except comparatively small quantities made from potatoes, principally in Maine, the starch of the United States is produced from corn, and some of its starch establishments are doubtless the largest in the world. A considerable number of food preparations, consisting of nearly pure starch, have their basis also in corn, as corn-starch, maziana, and similar products. The aggregate amount produced is quite large, and they are taking the place, in this country at least, of the various finer forms of starch, like arrowroot, and their consumption is increasing. Good sound corn, in the best-conducted starch factories, will yield about 40 per cent. manufactured starch. If the grain is very sound and very dry it will produce more, — sometimes as much as twenty-five pounds per bushel of corn; but, as much of the corn comes to market, its water-content is large, and the actual amount of starch produced probably averages not over 22 or 23 pounds per bushel of corn used."

**Glucose.** — Corn is again in demand for the manufacture of "glucose," or "corn-starch-sugar," and large quantities are used for this purpose. Glucose is made by the action of sulphuric acid on the starch of the grain, and from 26 to 32 pounds of glucose is made from a bushel of corn.

As glucose is cheaper than cane sugar or honey, it is largely used in a variety of forms as a substitute for these standard sweets, but, at the best, it has only about two-thirds the sweetening power of cane sugar. Table syrups are made of glucose, with the addition of from three to ten per cent. of cane syrup, according to circumstances, and all forms of candies and caramels are made almost exclusively of glucose.

In the adulteration of honey it is used in a variety of ways. Glucose is extensively fed to bees, and they seem to be fond of it, but they store it up as glucose, not honey. Strained honey is often adulterated with glucose.[1]

In the malting of barley the object is to convert the largest amount of starch into starch-sugar, and brewers are now using, to a considerable and increasing extent, corn glucose as a substitute for the more expensive natural product from barley.

Aside from the large demand for glucose for these purposes, it is used in the manufacture of wine, vinegar, tobacco, mucilage, and in distilling, and there is a growing demand for it in quite a number of industries.

The manufacture of glucose, or starch-sugar, is rapidly increasing. "On August 1, 1880, ten glucose factories were in operation in the United States, consuming daily about 20,000 bushels of corn." Professor Brewer thinks this estimate too low; and he claims from personal knowledge "that the capacity of one or two of these factories was greatly underrated." At the time mentioned nine factories were in process of construction, and in May, 1881, it was estimated "that the total consumption of corn for sugar and syrup-making is not far from 35,000 bushels" per day. It was estimated that in the year 1881 at least 11,000,000 bushels of corn would be used in these factories, with a prospect that the amount would be doubled in the following year.

In January, 1884, a committee of the National Academy of Sciences, consisting of Professors Barker, Brewer, Gibbs, and Chandler, reported that "the starch-sugar industry in the United States gives employment to 29 factories, having an estimated capital of five millions of dollars, consuming about 40,000 bushels of corn per day, and producing grape-sugar and glucose of the annual value of nearly ten millions of dollars." In a lecture delivered before the Chemical Society of Washington in January, 1890, Mr. Edgar Richards says, from information obtained from the American Glucose Company of Buffalo, New York, in December, 1889, "the number of starch-sugar factories in the United States has decreased to twelve, with a capital invested, estimated at from twelve to fifteen million dollars, consuming about 50,000 bushels of corn per day, and having an annual production of 450,000,000 pounds, valued at $10,500,000."

These glucose factories are conducted so that the product may be disposed of as starch, or as glucose, as the condition of the markets may from time to time demand.

Considerable attention has also been given, from time to time, to the manufacture of syrup or molasses from corn, but for various reasons this has not as yet been found profitable. Indian corn contains, on the average, about 5 per cent. of oil, and this has been utilized, as a bye-product, in the glucose factories, to a considerable extent. It has been used for burning in lamps, and a considerable portion of the product is shipped to England, and from there to Africa. That having the latter destination is probably, according to

[1] The statement has been widely circulated that "artificial honey" has been made, with combs of paraffine filled with glucose, but this is undoubtedly an error, as the offer of $1,000 for a sample has failed to produce it.

Professor Brewer, used to adulterate palm oil, and palm-oil soaps, but the extent of its use for this purpose has not been made public.

These home products of corn are of especial interest to the farmer, as a market for his crop, as, at the present time, the corn consumed in their manufacture considerably exceeds in amount the average annual export of the grain, with a good prospect of a considerable increase in the future, besides they create a demand for other produce to maintain those engaged in these special industries. There is no other cereal that serves so great a variety of purposes, or that offers such inducements for increased attention and skill in its cultivation.

**Corn as a Forage Crop.**— As a forage crop corn is deservedly receiving increased attention in almost every part of the country. As a supplementary, or even as a staple supply of feed for the summer months, and for winter feeding, either as dry fodder, or in the form of silage, it is extensively grown, and there is no other crop that can compete with it in the amount of valuable feed produced per acre, under proper management, on the average farms of the United States.

**Thick Seeding.**— One of the most common mistakes in its cultivation as a forage crop is too thick seeding. But a few years ago from one to three bushels of seed per acre was the rule, and some extremists even used as high as eight bushels, while at the present time the more reasonable recommendation of from ten to fourteen quarts is oftener made. The excessive yields obtained from thick seeding, when measured or estimated simply in pounds per acre, are misleading, as the crop under such conditions contains a large proportion of water with a corresponding deficiency in dry substance, which alone has a nutritive value. With thick seeding the plants are crowded in such dense masses that the stalks and leaves are of a pale yellowish green color, which indicates a sickly habit of the crop, from defective assimilation and the scanty formation of organic substance. An abundance of air and light are quite as essential conditions of a vigorous healthy growth and maturity of the crop as the supply of nutritive soil constituents, as will be seen from a consideration of some of the established facts relating to the nutrition of plants.

**Physiology of Plant Nutrition.**— A large proportion (about one-half) of the organic substance of the crop is carbon, the larger part of which is derived directly from the carbonic acid of the atmosphere. Under ordinary, or average, conditions the atmosphere has the following composition :

| | Volume. |
|---|---|
| Oxygen, | 20.96 |
| Nitrogen, | 79.00 |
| Carbonic Acid, | 0 04 |
| Total, | 100.00 |

Now the carbon contained in this small percentage of carbonic acid in the atmosphere is the main source from which the carbon of the plant is derived, and it can only be appropriated and fixed in the presence of light. This process of appropriating carbon by the plant is therefore only carried on by daylight, and is entirely suspended at night. From this it is evident that a rapidly growing crop, like Indian corn, must have free access to *light and air*, in order to enable it to obtain the large amount of carbon it requires in its growth from the minute percentage of carbonic acid contained in the atmosphere.

But there is another fact of prime importance that must be kept in mind ; this appropriation of carbon by the plant from the carbonic acid of the atmosphere, in the presence of light is exclusively effected by the dark green chlorophyll that gives the plant its natural color. The color of the plant is, then, a reliable index of the activity of the process of nutrition and the consequent construction of organic substances. A dark green color indi-

cates an active assimilation of carbon and healthy growth; while, on the other hand, a pale yellowish green color indicates defective nutrition, and the popular expression that the plant "looks sickly" is literally true.

With too thick seeding the plants are so crowded that there is not a free circulation of air, and there is consequently a deficient supply of carbon; moreover, the light under the mass of foliage is not sufficiently intense for the active assimilation of the small supplies of carbon that are present, and the result is a pale, slender, spindling growth that is lacking in the elements of healthy vigor. The upper leaves are alone placed in conditions that will enable them to carry on the processes of nutrition and growth in a healthy manner, and but part of the working machinery of the crop is, therefore, performing useful work.

No absolute or arbitrary rule can be laid down as to the proper distance of planting, as much will depend on the habits of leaf distribution and extension in the different varieties. It is safe to say, however, that when the lower leaves and stalks are pale, or yellowish green, on a well-cultivated and productive soil, the crop is too closely planted to obtain the best results.

For the best development of the crop for forage, the formation of ears to some extent, at least, as the crop matures, is desirable, and nearly the same distance may be given in the rows, as in ordinary field culture where grain is the leading object. If small stalks are desirable, the smaller varieties may be grown, but slender stalks should not be made by crowding from thick seeding.

The nutritive value of the crop will also be increased by allowing the plant to approach maturity before it is harvested. For early summer feeding, then, it will be an object to plant early quick-growing sorts, while for feeding late in the season the larger varieties may be used, but the varieties selected should always be capable of reaching maturity under the average climatic conditions of the locality.

Experiments show that the dry substance of the crop is constantly increasing until the period of maturity is nearly or quite reached, and that the full value of the crop as cattle food cannot be realized if it is harvested in the early stages of its growth, even when planted under the most favorable conditions for its growth and development. With this crop, perhaps, more than with any other, quality is of greater importance than mere quantity.

Corn should never be sowed broadcast as a forage crop, but in drills, so that it can be cultivated during the early stages of its growth. On the start the smoothing harrow may be used to advantage to keep the crop free from weeds, as clean cultivation is quite as important as in growing the ordinary field crops.

## WHEAT.

While corn takes the lead of all cereals in the amount and value of its production as a feeding crop, wheat must take the first rank as a bread crop.

Its range of distribution is nearly the same as Indian corn, but in the extreme West it is successfully cultivated where corn is not grown.

According to the statistics of the census of 1880, 58.2 per cent of the total crop of the United States is grown between 38° and 42° of latitude and 83.1 per cent. between the parallels of 37° and 44°.

**Temperature.** — Sixty-seven and one-half per cent. of the crop is grown where the mean annual temperature is between 45° and 55°.

With a mean midsummer temperature of 65° to 85° over 93 per cent. of the crop is grown; between 70° and 80°, 87.6 per cent.; between 75° and 80°, 38.9 per cent., and between 70° to 75°, 48.7 per cent.

**Rainfall.** — With an annual rainfall of 40 to 45 inches, 28.8 per cent. of the crop is grown; with 35 to 50 inches, 62.7 per cent.; and above 25 inches 92.4 per cent. Where the rainfall of the growing season is from 20 to 25 inches, 48 per cent. of the crop is grown; from 15 to 25 inches, 79.7 per cent.; below 15 inches 6.4 per cent., and where it is below 10 inches only 1.0 per cent.

**Elevation.** — Fifty-two per cent. of the crop is grown between 500 and 1,000 feet above sea level; 25.7 per cent. between 1,000 and 1,500 feet; 11.6 per cent. between 100 and 500 feet; and 93.8 per cent. below 1,500 above the level of the sea.

**Varieties.** — The known varieties of wheat are adapted to great differences in climatic conditions. The acquired habits of growth of a variety may be modified by a change of conditions, and these new characters, if the conditions remain the same for some time, become fixed in the improved variety. Fall wheats may be sown in the spring, but as a rule the spring sorts are too delicate for fall sowing.

In Michigan I have sowed fall wheat in January and obtained a good crop, although the seed did not of course sprout until the following spring. In another season, wheat sowed the first week in October had not sprouted on the 25th of December, on account of the prevailing drought. The crop, however, averaged 28 bushels per acre, and it did not apparently suffer from its failure to make any growth in the fall.

In the older States that have passed the pioneer conditions of farm practice, preparation for the wheat crop should be made in the cultivation of the preceding crops of the rotation. The soil should be in good condition from the residues of the barnyard manure applied to the corn crop and the root residues of other crops, and it should likewise be free from weeds.

The tendency of grain crops is to promote the growth of weeds, and the land should therefore be clean when a grain crop is sowed. The cultivation of growing wheat is not to be recommended, as the increase in the crop, at the prevailing low prices, will not be likely to pay for the labor expended. Indian corn is a better cleaning crop than wheat, and it had better precede the wheat if the land is weedy. Indian corn followed by oats and then wheat is a good order of succession, as there is but little interval between the crops, and there is ample time for preparing for the oats and wheat.

In the United States, with a comparatively hot and dry atmosphere during the period of growth and ripening, the quality of the crop will depend more on the variety sown than in England where the climatic conditions are not as favorable for the maturity of the crop. In some localities the winter wheats are of good quality, while the spring-sown sorts do not flourish as well; while in other localities the reverse is true as a rule. In the extreme Northwest some varieties are sown indifferently in the fall or spring, and the quality of the grain is essentially the same in either case.

Wheat sowed in drills in the fall is less liable to winter kill than that sowed broadcast, and aside from the mere matter of convenience in putting in the crop, this appears to be the principal advantage of drilling in the crop.

Deep plowing is, as a general rule, desirable, but the roller should be used for compacting the well-tilled soil, especially when the crop is sown in the fall. The variety sown should be adapted to the locality, but a careful selection of seed is of still greater importance in securing a high yield and a superior quality of grain. The chemical composition of the grain appears to depend more upon the variety than upon soil or climate, provided the conditions are favorable for the complete maturity of the crop.

# OATS.

Oats rank as the third cereal in economic importance in the United States. They are best adapted to a cool moist climate, and at the north the best quality of grain is produced. Unlike corn and wheat, the greatest production is south of the regions in which the best quality of the grain is grown. In the six States, already enumerated as producing over 53 per cent. of the total crop of 1888, the legal weight of a bushel of oats is 32 pounds, and in most of these States a crop of good quality is required to come up to the standard. In Oregon and Washington 36 pounds; in Montana 35 pounds; and in Nebraska 34 pounds are the legal weights of a bushel, while in Maryland it is only 26 pounds, and in New Jersey 30 pounds. This wide range of variation in the legal weight of a bushel indicates marked differences in the quality of the grain in the different regions.

In answer to the special schedule question (U. S. Census 1880), "What is the range in weight per bushel of the crop of 1879, the lightest in pounds, the average, the heaviest? the range was given all the way from 20 to 45 pounds, comparatively few, however, going below 25 or above 40 pounds, but a large number falling between 25 and 40. All of the greater oat-producing States gave the highest weight of their oats at above 40 pounds. In Washington the range was given from 32 to 46 pounds; in Dakota from 31 to 45; in Oregon from 30 to 50. What the maximum weight of oats grown in the United States is, is uncertain, but a number of unauthenticated reports of oats weighing over 50 pounds per bushel have come from Montana, Idaho, Oregon, and Washington."

"The importation of Scandinavian oats (particularly from Norway) into our northwestern States is also carried on to some extent, with such an increase of crop that it is a question whether the subject is not of sufficient importance to induce the National Government to furnish the means of transporting seed oats from Norway into those regions from year to year. That the weight produced from seed so obtained is greater is well demonstrated, and in numerous oat-growing localities the best grain is always produced from seed brought from some point further north.

"In some oat-growing localities, however, no such increase is produced, and the best grain in such localities is always produced from home-grown seed which has been the result of long-continued selection. In places that have been reported there are local varieties which are heavier than any that can be got from seed grown elsewhere." The sample "from Long Island is an illustration. It has long been cultivated in that locality, and weighs 42 pounds per bushel, which is heavier than they can get in that locality from imported seed."

In the northern range of the crop, as in Nova Scotia, from 40 to 48 pounds per bushel may be obtained. As a general rule, seed from northern localities where the crop gives the heaviest grain per bushel may with advantage be used. In Michigan I have raised over ninety bushels of oats per acre, the measured bushel weighing 43 pounds, from seed raised in Nova Scotia that weighed 48 pounds per bushel; while the crop from Michigan-grown seed, under similar conditions of cultivation, gave a yield of but 45 bushels per acre,—weighing less than 32 pounds per bushel. The oats grown from Nova Scotia seed were saved for seed, and in the course of four or five years the weight per bushel was gradually reduced to 33 or 34 pounds, and after that there was no material difference in weight from the ordinary Michigan oats. If seed could be obtained from the north every three or four years, at a reasonable rate, it would add much to the yield and profits of the crop.

"In the distribution of the crop in respect to latitude there is not that concentration of production, between certain parallels, that is shown in either of the preceding grains. The amount grown within each of the three degrees of latitude, between 40° and 43°, is nearly

the same, the aggregate amounting to 224,566,499 bushels, or about 55 per cent." of the total crop.

**Elevation and Temperature.**—As to elevation, "over 91 per cent. of the crop is grown between the altitudes of 100 and 1,500 feet" above the sea level.

"More than one-half of the whole crop grows where the mean annual temperature is between 45 and 60 degrees." The greatest production is where the mean January temperature is between 20° and 25°, and 80.9 per cent. of the crop grows where it is below 30°.

Eleven and nine-tenths per cent. of the crop grows where the mean July temperature is 65° to 70°; 53.5 per cent. where it is 70° to 75°, and 27.7 per cent. where it is 75° to 80°.

"Four-fifths of the crop is where the mean annual rainfall is between 30 and 45 inches, and where the spring and summer rainfall is between 15 and 25 inches."

In the northern States early sowing must be practiced to obtain the climatic conditions most favorable to the maturing of the crop, while in the southern States, for the same reason, the crop is now largely grown in the winter months.

In 1888 there was an increased acreage of oats in every State, and also an increased production in every State, with a single exception.

## BARLEY.

In area under cultivation, and in total value of the crop, barley ranks fourth in importance of the cereals of the United States, and the peculiarities of its distribution are especially interesting. It is adapted to a wider range of climatic conditions than any other cereal. In his report on the cereals, Professor Brewer says, "It is the most hardy of all the cereals, and is cultivated farther north, fields of it being found in the Orkney, Shetland, and the Faroe islands to latitude 62°; in western Lapland to latitude 70°, near the North Cape; in Russia to the shores of the White Sea, above latitude 67°; and in central Siberia farther north than any other grain, and nearly up to the point where all cultivation ceases, potatoes being the only important food-plant ranging farther north in the old world, and the limit of barley and potatoes forming the line between an agricultural and a pastoral or nomadic life. On the other hand, barley flourishes well in semi-tropical countries, and in this country the State of its greatest production is where the fig, the lemon, and the orange flourish. In Arizona and Nevada more of barley than of any other cereal was grown in the census year."

In distribution, according to climatic conditions, in the United States "the greatest production of barley is with a smaller amount of annual rainfall, and also a smaller amount of rainfall during the growing season, than is found with either of the other cereals, illustrating, in another way, the curious range of the crop as to climate. Its greatest production is where the rainfall of the growing season is between 15 and 20 inches, the production of each of the other cereals being greatest where the rainfall during the same period is between 20 and 25 inches. Nevertheless, some regions of the United States producing exceptionally good barley are regions of very high rainfall, while the climate of Canada, as also that of northern Europe, where barley is grown of very great excellence, is exceedingly wet, as compared with the drier regions here indicated. A much larger percentage of the crop grows where the rainfall of the growing season is less than 15 inches than of either of the other cereals."

With this wide range of varied conditions under which the crop is successfully cultivated, it is remarkable that with a material increase in area and production, for the same period, the importation of barley into the United States from 1870 to 1888 inclusive, averaged 7,941,532 bushels per year; and from 1882 to 1888 inclusive the annual average im-

ported was over 10,000,000 bushels. The imported barley is chiefly from Canada, and largely for malting. Glucose manufactured from Indian corn, is however used to so large an extent in beer-making that it has considerably diminished the demand for the importation of barley.

In 1839, the total production of barley in the United States was 4,161,504 bushels; in 1859, 15,825,898 bushels; in 1879, 44,113,495 bushels; and in 1888, 56,812,000 bushels.

In 1879, the barley imported was 5,720,979 bushels; and in 1888, 10,831,461 bushels; and the increase seems to be quite as large in proportion as the increased production.

Some of the statistics of the crop of 1879 for the States producing over 1,000,000 bushels are given in the following table:

TABLE 26.

*Statistics of Barley, 1879.*

| | States. | Acres. | Bushels. | Per cent. of Total Product. | Cumulative per cent. |
|---|---|---|---|---|---|
| 1 | California, | 586,340 | 12,579,561 | 28.52 | 28.52 |
| 2 | New York, | 356,629 | 7,792,062 | 17.66 | 46.18 |
| 3 | Wisconsin, | 204,335 | 5,043,118 | 11.43 | 57.61 |
| 4 | Iowa, | 198,861 | 4,022,588 | 9.12 | 66.73 |
| 5 | Minnesota, | 116,020 | 2,972,965 | 6.74 | 73.47 |
| 6 | Nebraska, | 115,201 | 1,744,686 | 3.96 | 77.43 |
| 7 | Ohio, | 57,482 | 1,707,129 | 3.87 | 81.30 |
| 8 | Illinois, | 55,267 | 1,229,523 | 2.79 | 84.09 |
| 9 | Michigan, | 54,506 | 1,204,316 | 2.73 | 86.82 |

Nearly 87 per cent. of the crop was grown in the nine States named. California produced more than one-fourth, California and New York over 46 per cent., and the first four States enumerated more than two-thirds of the crop, while Michigan produced less than three per cent., and the other States not named a still smaller percentage. These anomalies in distribution and production are not readily explained, and it is probable that a number of factors are concerned in the result.

"In California the great production is due to two causes, the first, of course, being that the climate and soil are well adapted to the crop, while the other is that neither climate nor soil is so well adapted to the growth of either oats or corn. From similar causes barley is the chief cereal in Arizona and Nevada."

The increased production in New York and other northern States has been attributed to the increased demand for malting, and the relative higher price of the grain, and also to the falling off in wheat growing, owing to the ravages of insects. How far the latter cause is concerned it is difficult to determine. In England, with a gradual decline in wheat growing on account of foreign competition, there was an increase in barley up to 1880, but since that time the area in barley has gradually diminished, while there has been a decided increase in importations.

Professor Brewer remarks that "there are anomalies in the distribution of barley production in the United States which are quite remarkable. Pennsylvania produces less than half a million of bushels, while New York, similar to it in its other products, produces nearly eighteen times as much. Indiana produces less than 383,000 bushels, while the three States of Illinois, Michigan, and Ohio, which surround it on three sides, produce over 4,000,000 bushels, and each of them produces from three to four and a half times as much as Indiana. These enormous differences in production are not explained by differences of either soil, climate, or markets."

According to the Department of Agriculture Report for 1888, barley "gives a better return in value per acre than any other cereal. The rate of yield varies annually, but

averages nearly twice as much as wheat." From these facts an increased cultivation of the crop might reasonably be expected, but American farmers, as a rule, are independent, and they do not always do what pays best, but prefer to consult their own notions of comfort and convenience.

A number of farmers of my acquaintance object to growing barley simply because it is "an uncomfortable grain to harvest," and others do not grow it on account of its use in making beer.

Barley is a valuable cattle food, and there appears to be no good reason why it cannot be profitably grown, to a greater extent, to increase the variety of crops in rotations, which, on many accounts, may be desirable.

## RYE.

During the last ten years there has been an increased acreage of rye in the United States, but not in proportion to the increase of population, and with the greater area there has been a falling off in the aggregate production. The crop has a considerably smaller area than any of the other cereals, with the single exception of buckwheat.

In some localities in the Eastern States it is grown almost exclusively for the straw, which brings a high price in the cities, and is in demand in the manufacture of various articles in which straw is extensively used as the raw material, while the grain is considered as of secondary importance.

At the West, rye is grown to a considerable extent as a "catch crop," for forage, to fill the interval between other crops and keep the land fully occupied. This commendable practice is becoming more popular, and as better methods prevail it must be materially extended. At the South it is coming in favor as a forage crop, especially for winter pasture, and also as a green manuring crop on worn-out lands. In all of these cases the grain is grown almost entirely for seed.

As a bread-plant it has been almost entirely superseded by wheat, and as a grain crop it is of but little interest. Three-fourths of the total crop in 1879 was produced by the following States, the relative amount for each being indicated in the order named: 1, Pennsylvania; 2, Illinois; 3, New York; 4, Wisconsin; 5, Iowa; 6, New Jersey; 7, Kentucky.

Pennsylvania and New York "produced 51 per cent. of the total crop in 1839; in 1849, 63 per cent.; in 1859, 48 per cent.; and in 1869, 36 per cent. In 1879 these States, with Illinois, produced "a little less than half, and in 1869, fully half of the total crop. The distribution of the crop in these States is very unequal, being in part governed by the soil, and in part by the local demand for the straw. Formerly New England produced relatively a vastly larger proportion. In 1850 Connecticut ranked the third and Massachusetts the fourth State in order of production. In many of the States there has been a considerable falling off in production during the last decade (1870 to 1880). This is notably the case in Delaware, Kentucky, Indiana, Virginia, the Carolinas, and all of the New England States, except Connecticut, where the falling off took place earlier. The increased cultivation of oats in the South for green forage and green manuring, and the spread of other forage plants, has had a relative tendency, during late years, to diminish its cultivation in some portions of those States."

## BUCKWHEAT.

Buckwheat, as well as rye, seems to be declining in popular favor. For the years 1880 to 1887 inclusive, the annual production averaged 11,155,880 bushels, while the average for the preceding ten years was 9,747,272 bushels. This absolute increase in the crops is

not, however, in proportion to the increase in population, and it is much less than the relative increase of the other cereals.

The two States, New York and Pennsylvania, produced 59 per cent. of the crop in 1839; 60 per cent. in 1849; 61 per cent. in 1859; 65 per cent. in 1869, and 68 per cent. in 1879. At the present time they produce about two-thirds of the total crop. "The portions of these States where the production is largest are in the hilly countries, particularly on the highlands that lie on the divide between the lakes and the Chesapeake and Delaware Bays, and on the lower mountains and hills that form the outlying ridges of the Appalachian system. In many such places where a comparatively thin soil is found it is a somewhat important crop."

## TILE DRAINING.

**Advantages of Draining.**— The advantages of a well-drained soil are not fully appreciated by farmers generally, and even the writers on draining overlook the most important benefits that may be derived from it as a means of increased productiveness.

We are told that on land holding an excess of water in the soil, or subsoil, draining warms the soil and lengthens the season, so that the land may be worked earlier in the spring and later in the fall, and even immediately after heavy showers that would otherwise interfere with cultivation, and that the soil is deepened, giving the roots of plants a greater range and thereby diminishing the effects of droughts from the deeper root distribution of the growing crop.

These are important considerations, especially with reference to the economy of labor in the management of the farm, and the greater feeding range of the roots of growing crops, but they do not by any means represent all, or even the most essential, of the ameliorating effects of drainage on the soil.

Under present conditions of production with extended competition and low prices of farm products, the farmer must, as far as possible, make the stores of fertility in the soil and the fertility supplied in the form of manure available in the growth of crops, and this can only be done on well drained land.

No matter what precautions may be taken for preserving and utilizing the elements of fertility in the soil, and in the manures applied to it, thorough drainage must be secured to make them effective.

We have seen that the stores of fertility in soils and manures are not in an available form for the nutrition of plants until they have been subjected to a series of changes which we have designated under the convenient general term, metabolism. Active soil metabolism must then be looked upon as an essential condition for the elaboration of plant food from the more complex combinations in which it exists in the ordinary stores or sources of fertility.

But there are good reasons for the belief that soil metabolism is largely brought about by the vital activities of living organisms in the soil and these efficient agents in the preparation of plant food must be placed in suitable conditions for their growth, multiplication, and general well being, or they cannot perform the work assigned them in the economy of nature. Doubts can no longer be raised as to the importance of these considerations, as the latest investigations in biological science all tend to strengthen the evidence relating to the agency of micro-organisms in elaborating plant food in the soil, and it must be admitted that plants are largely dependent on them for the supplies of food that their roots can appropriate.

On well-drained land the roots of growing crops are not only more widely and deeply distributed, but they find abundant supplies of suitable food prepared for them that has been formed from the soil constituents and the manures through the agency of the living organ-

isms that find favorable conditions for the exercise of their activities. Moreover, under such conditions, there are indications to which attention has already been directed, that certain species of microbes may appropriate free nitrogen from the atmosphere that permeates the porous soil, particularly in the vicinity of the roots of leguminous plants, and thus add to the fertility of the soil.

On the other hand, when a soil containing organic matters in abundance is saturated with water, the metabolism is diminished and different in its character, and it not only involves a waste of the elements of fertility in various ways, but proper plant food is not elaborated. Thorough drainage is, therefore, absolutely necessary to make the raw materials of plant food available for any useful purpose.

This knowledge of the biological factors of soil metabolism throws a new light on the relations of the soil to plant growth that are of great practical interest, and a reasonable explanation can now be given of those cases in which the application of manures do not produce the expected results.

The soil must not only be supplied with the chemical elements of fertility, but it must also be in a condition that is favorable to the life and well being of the living organisms that are the dominant factors in preparing these crude materials for the nutrition of plants.

While some of the most obvious advantages of thorough draining have been recognized, it is undoubtedly true that a large proportion of the drains in this country and England have failed after a few years to act efficiently, on account of the imperfect manner in which they have been made, and this has perhaps led many farmers to have doubts as to the economy of thorough draining, at least on lands that produce fair crops in good seasons.

Under the present conditions of agriculture in all of the older States it must, however, be admitted that a considerable proportion of the land under cultivation would be improved by draining, while extensive areas that are now worthless may be reclaimed and made highly productive. A somewhat detailed discussion of the principles involved in the construction of permanent drains and the best methods of laying tiles must therefore be of general interest.

To work effectively, tile drains must be laid on a true grade, that is to say, without vertical undulations from a right line, and the joints between the tiles must be so close that silt cannot wash in from the outside, and under such conditions they may fairly be included in the class of permanent improvements.

Silt basins were formerly recommended to catch the silt at the junctions of drains, so that it might not accumulate further down and cause an obstruction.

From what is now known in regard to the principles of draining, and the results of experience, it appears that the presence of silt in a tile drain (aside from what enters in the process of construction, which, with reasonable care, should be inconsiderable,) is conclusive evidence that the tiles have not been properly laid, as one of the prominent points aimed at in laying the tiles should be to prevent silt from entering them.

It seems to be a popular notion that provision should be made for the water to get into the drain, and many failures in tile draining may be attributed to the attempt to furnish the water in the soil a ready passage into the tiles. The results of such efforts are open joints. through which silt is readily washed into the tiles to check the current of water and ultimately cause a complete stoppage of the drain.

By reversing the conditions the futility of open joints to admit water to the tiles will be obvious. No one would think of carrying water any distance in pipes with joints every twelve inches that are not cemented and made perfectly water tight. It would be said at once that the water would leak out and be lost. This is true; and it is quite as impossible to lay a tile drain into which the water will not leak at every joint unless they are carefully cemented, and even then especial pains must be taken if the water is kept out.

How does water enter a tile drain? The correct answer to this question will remove a number of fancied difficulties in tile draining.

**Water Table.**—If a hole is dug in wet land the water will be found to stand in it at a certain level, and the surface of this stagnant water is, for convenience, called the water-table. Now, when tiles are laid the water-table is lowered, and in time of drought it may be considerably below the bottom of the tiles. If a rain then falls in excess of the absorbent capacity of the soil, the water percolates directly downwards to the water-table and gradually raises it until it reaches the tiles, when it "leaks in" at the lower part of every joint and begins to run off through the tiles. It may then be said that water enters the tiles by leaking in at the bottom of the joints, when the water-table is raised to come in contact with them, and this should be the only way in which water can find its way into the tiles. When the water-table is below the bottom of the tiles the drain, of course, ceases to run, as is the case with most drains during the summer months that are not supplied by perennial springs. When the water-table is just above the bottom of the tiles there is a moderate flow, and as it raises higher the drain runs full.

If the tiles are laid so that silt cannot enter at the upper part of the joints, it will not be likely to work up from the bottom, and even in quicksand there is no danger of this if the ends of the tiles are in contact on all sides.

**Size of Tiles.**—As the cost of draining will depend largely on the size of tiles used, it will be best, on the score of economy, to use the smallest sizes that will safely answer the purpose. The relative prices of tiles are not, of course, the same in all localities, but they will not vary widely from the following list of prices, in car-load lots, in Michigan:

| | | | | | |
|---|---|---|---|---|---|
| 2 | inch tiles, | 1 foot long, | $12.00 | per 1,000 |
| 2½ | " | " | 14.00 | " |
| 3 | " | " | 17.00 | " |
| 4 | " | " | 26.00 | " |
| 5 | " | " | 36.00 | " |
| 6 | " | " | 46.00 | " |
| 8 | " | " | 90 00 | " |
| 10 | " | " | 135.00 | " |
| 12 | " | " | 180.00 | " |

The tiles should, of course, be large enough to carry off the water with reasonable rapidity, but the use of 12-inch tiles where 6-inch tiles would answer, or 6-inch tiles where 5 or 4 or even 3-inch tiles would be sufficient, involves needless expense without materially increasing the efficiency of the system of drains.

There seems to be a tendency to overestimate the size of tiles required for a given area, from the attention given to tables of the capacity of pipes when used as sewers. The differences between sewers and land drains are so marked that particulars required in the one are not strictly applicable in the other.

Sewers have cemented water-tight joints, and the mains must have a capacity to discharge, without delay, all of the water received from the laterals when running full; and as the laterals receive the water from the roofs of buildings and from the streets, in mass, they must have a capacity to carry all the water of a heavy rainfall in a very short time.

With drains laid to the depth of three or four feet, the conditions are quite different, as the soil above the tiles is never saturated with water under any ordinary conditions of precipitation, and a heavy rain must soak gradually down through the porous absorbent soil before it can reach the water-table and raise it so that it will be discharged by the tiles.

The mass of three or four feet in depth of more or less absorbent soil above the drains may, in fact, be looked upon as a reservoir for the storage of the rainfall, and its gradual

diffusion to the water-table below; and the deeper drains would, therefore, have an advantage from the greater capacity of the storage reservoir of soil above them.

When the water-table is three or four feet below the surface of the soil on drained land, a rainfall of one or two inches in twenty-four hours that percolated rapidly through the soil would not raise it sufficiently to interfere with growing crops, as the tiles would keep working to discharge the water as it reached the drains, and even two or three inches of rainfall in an hour or two could not saturate the soil to the depth of two feet.

From these facts it must be evident that a large portion of such rainfalls would be retained by the soil several hours at least before reaching the water-table, and then a very large proportion must flow laterally through the soil a considerable distance before it can reach the drains, which would still further aid in the gradual delivery of the water to the tiles, and there would consequently be time for its discharge by the drains to prevent its accumulation and a rise of the water-table to any great extent.

The rate and amount of percolation of water through the soil in a given time will depend upon the depth of the drain; the permeability and absorbent powers of the soil, including its previous condition as to moisture; the rate of evaporation from the surface soil; and the amount of water exhaled by a growing crop.

The significance of these factors on the amount of drainage from a given rainfall, and the rate of progress of the water through the soil, will be made apparent when we inquire into the manner in which the water, falling on the soil as rain, is disposed of.

Professor S. W. Johnson's valuable work, *How Crops Feed*, may be consulted with advantage in regard to the absorbent properties of soils, which we cannot, for want of space, discuss in detail.

From the well-known experiments of Schübler it appears that the class of soils that generally require draining are, when dry, capable of absorbing from 40 to 89 per cent. of water, and that when saturated, if spread over a given surface, they lose from 24 to 45 per cent. of their water in four hours by evaporation.

The results of some of the experiments at Rothamsted, as given in Tables 1, 5, 6, and 7 in the preceding pages, are likewise of especial interest in this connection. According to Table 1, the average annual rainfall for 17 years on the bare soil of the drain-gauges was 30.46 inches, of which only 14.41 inches appeared in the drainage, and 16.05 inches was retained by the soil or evaporated; and during seven months of the year, from March to September inclusive, the average rainfall for the same period was 16.62 inches, of which only 4.59 inches was lost by drainage, while 12.03 inches was retained by the soil or evaporated from its surface. In the drainage year 1878–9 (October to September), with the excessive rainfall of over 42 inches, but 25.8 inches appeared in the drainage, and 16.8 inches was either evaporated or stored up in the soil of the drain-gauges.

Turning now to Table 5, we find that in January there was nearly twice as much water in the soil of the drained experimental wheat-plots as in July, and in Table 7 the results are given for three of these plots in tons per acre. It is here seen that this soil in January contained from 730 to 1,019 tons of water per acre more than was found in July, and this difference would represent a rainfall of from 7 to 10 inches, while the total rainfall for the period was about 16 inches.

This soil, then, even when containing sufficient water to meet the requirements of a growing crop, seems to be capable of storing up an amount of water equivalent to a rainfall of seven to ten inches.

**Rainfall in the United States.** — Rainfalls of over 3 inches in 24 hours in the United States are rare, and may be looked upon as exceptional. In 1886, in the twenty-six States east of the Mississippi River a rainfall of 3 inches or more in 24 hours is reported,

once in each of 13 States, twice in four States, and four times in New Jersey, with an annual rainfall of 42 to 50 inches at the different stations.

Of extraordinary rainfalls in 24 hours may be mentioned, 7.36 inches at Atlanta, Ga., in March ; 7.61 at Chattanooga, Tenn., in March ; and 12.91 inches at Brownsville, Texas, in September. The only obvious remedy for such remarkable rainfalls is deep and thorough drainage, and the perfect construction of the drains so that they may work to their full capacity for several days without danger of displacement. Drains four feet deep, under such conditions, would be much better than three-foot drains, on account of the greater storage capacity of the soil above them.

In the drain guages at the New York experiment station, with an average annual rainfall of 23.72 inches for six years, only 14.6 to 36.1 per cent. was discharged in the drainage, and, in the months of June, July, and August, on the average for six years, but 12.9 to 16.6 per cent. of the rainfall appeared in the drainage.

**Water Exhaled by Plants.** — The water exhaled by a growing crop is enormous, and it must have a marked influence on the capacity of a soil for storing water, and thus diminishing the amount to be disposed of by drainage.

In Table 6 it will be seen that fallow land was found to contain about 900 tons of water per acre, to the depth of 54 inches, more than land on which barley was growing, a difference that is equivalent to nearly nine inches of rainfall. As the evaporation from the surface of the fallow land would in all probability exceed that from the surface of the barley land, as it would not be protected by the shade of a crop, the water exhaled by the growing barley was probably more than the amount of difference in the water contained in the soil of the two plots.

There are many other experiments relating to the exhalation of water by growing plants that are quite as suggestive. In *How Crops Feed* we are told that "Hales, the earliest observer of this phenomena, found that a sunflower whose foliage had 39 square feet of surface, gave off in 24 hours 3 pounds of water. A cabbage whose surface of leaves equaled 19 square feet exhaled in the same time nearly as much. Schleiden found the loss of water from a square foot of grass sod to be more than 1½ pounds in 24 hours. Schübler states that in the same time one square foot of pasture grass exhaled nearly 5½ pounds of water. In one of Knop's more recent experiments a dwarf bean exhaled during 23 days in September and October, 13 times its weight of water. In another trial a maize plant transpired 36 times its weight of water from May 22d to September 4th. According to Knop, a grass plant will exhale its own weight of water in 24 hours of hot and dry summer weather."

In the elaborate experiments at Rothamsted, on the exhalation of water by plants, it was found probable that, "on the average, from 250 to 300 parts of water are given off for 1 part of total dry substance fixed or assimilated" by ordinary farm crops, and Drs. Lawes and Gilbert make the estimate that there was "750 tons of water evaporated per acre" in the growth of several of the experimental wheat field crops.

On the same basis of calculation a crop of Indian corn yielding 50 bushels of grain and 2¼ tons of stalks would exhale in its growth 860 tons of water per acre, or the equivalent of about 8½ inches of rainfall.

**Drainage of River Basins.** — Each one of these checks to the free passage of water through the soil is of considerable importance, and the sum of their effects on drainage waters is clearly shown in the results of observations that have been made, on a large scale, to determine the drainage of river basins, with reference to the causes of floods, and the water supply for different purposes.

From the United States Signal Service Weather Report for 1887 it appears that the average annual precipitation at the signal stations of the several states and territories varies

widely, as will be seen from the following list of the twelve lowest and twelve highest records: Keeler, California, 1.94 inches; Yuma, Arizona, 2.82 inches; Frisco, Utah, 8.08 inches; Ft. Bridger, Wyoming, 8.55 inches; Poplar River, Montana, 8.95 inches; Winnemaca, Nevada, 9.74 inches; Montrose, California, 9.89 inches; San Diego, California, 10.83 inches; Cheyenne, Wyoming, 11.40 inches; El Paso, Texas, 11.78 inches; Fort Maginnis, Montana, 12.92 inches; and Fort Shaw, Montana, 13.56 inches.

Then, passing to the other extreme, we find Wilmington, North Carolina, 57.87 inches; Charleston, South Carolina, 58.92 inches; Chattanooga, Tennessee, 59.27 inches; Vicksburg, Mississippi, 60.54 inches; Kitty Hawk, North Carolina, 62.79 inches; New Orleans, Louisiana, 63.75 inches; Mobile, Alabama, 65.06 inches; Pensacola, Florida, 67.07 inches; Hatteras, North Carolina, 72.34 inches; Mt. Washington, New Hampshire, 83.53 inches; Tatoosh Island, Washington, 90.71 inches; and Sitka, Alaska, 111.72 inches, with a maximum of 140.26 inches in 1886.

The total average precipitation in the Mississippi River basin and its subdivisions for the year 1882 (a year of floods), together with the percentage discharged by the rivers, is estimated by Lieutenant Ellis as follows:

| | Total average precipitation in inches. | Percentage discharged by rivers as drainage. |
|---|---|---|
| Mississippi River Basin, | 36.43 | 25.0 |
| Ohio " " | 53.42 | 48.0 |
| Upper Mississippi River Basin, | 36.70 | 43.0 |
| Missouri " " | 21.38 | 10.0 |

In addition to the causes we have mentioned, which have an influence on the proportion of drainage to rainfall, climatic conditions should not be overlooked.

When the ground freezes in winter the precipitation in the form of snow may accumulate while a freezing temperature continues, and, when melted in the spring, it may nearly all be discharged by surface drainage without entering the soil. Moreover, the capacity of the air for moisture is less in winter, and evaporation is therefore less than in summer.

In the above statement the percentage of rainfall discharged by river drainage in the Ohio and Upper Mississippi basins is undoubtedly larger than would be discharged by tiles in land drainage, as a large proportion of the winter precipitation would probably be discharged by surface drainage.

In the Ohio River basin, for example, it has been shown that the winter precipitation has but little effect on the drainage waters discharged by tile drains. Lieutenant Ellis estimated the total average precipitation in the Ohio basin for the months of January, February, and March, 1882, at 19.0 inches, and that 78 per cent. was discharged by the river; while for the months of October, November, and December, that follow the drying, heated months of the summer, he estimates that the river carries off but about 17 per cent. of the rainfall.

Additional statistics to the same effect might be given, but these are sufficient to illustrate the principles involved in making estimates for land drainage.

From what has already been presented it is evident that the various factors concerned in disposing of the rain falling upon the soil should certainly be taken into consideration, in deciding upon the required capacity of drains for removing the surplus water from the soil in any particular case.

In the interests of strict economy it will not be safe to rely upon any arbitrary rule for determining the size of tiles required for a given area, as no direct relation can be shown

between the diameter of the tile and the demands that will be made upon its drainage capacity in any prescribed locality.

It is well, however, to keep in mind the fact that, after heavy, retentive soils are thoroughly drained, and growing large crops, the rainfall does not run through them without being retarded by a number of causes, which, acting together, must tend to prevent its immediate discharge by the drains, and at least several days must elapse before all of the surplus water of heavy rains can be carried off by the tiles.

In the published works on draining these modifying influences on the flow of water through the soil are almost entirely ignored, and, as a rule, larger tiles are recommended for the drainage of a given area than are really required.

**Drainage in Michigan.** — As a practical illustration of what may be accomplished with tiles of moderate size, the following example of successful draining is given. Several years ago, when visiting the farm of A. F. Wood, of Mason, Michigan, the farm-hands were at work deepening a large open ditch that served as an outlet for the surface drainage of a large part of the farm. As is often the case in the drift formation, veins or pockets of quicksand near the bottom of the ditch made it impossible to keep it open to a sufficient depth without clearing it out every year, and, evidently, it could not be relied upon as an outlet for the proposed tile draining of the lands lying above it.

My suggestion that the open ditch might be dispensed with by putting in a 6-inch tile to serve as an outlet for the tile drains that might be tributary to it was thought to be a wild one, as it was said a large volume of water was discharged through the open ditch every spring and fall, and it was assumed that several such tiles would not be sufficient to carry it.

After further experience with the open ditch, which was clearly inadequate as an outlet for the drainage basin tributary to it, Mr. Wood finally decided, after full consideration of the probabilities of success, to put in the 6-inch tile, as larger sizes, at that time, could not be procured at a reasonable price in that locality, and I was pleased to aid him in planning the system of drains for his farm, as the improvement gave promise of important results.

The 6-inch tile was carefully laid, on a grade of about 7 inches in 100 feet, in a trench made in the bottom of the open ditch, which was then filled up. At the upper end of the 6-inch tile bricks were laid to form a silt basin, or well, which was brought to the surface by one length of sewer pipe, to receive and carry to the drain any surface water that might accumulate after heavy rains while the tile drains were being laid. This was considered as a temporary expedient, as the surface water, as it was assumed would be the case, did not appear when the land was well drained and the falling rain could soak into the soil.

From this well, at the head of the 6-inch drain, branches were laid to serve as sub-mains for the required laterals, as follows: one of 5-inch tiles, running east 60 rods; one of 4-inch tiles, to the south, to drain a field the other side of the highway; and one of 3 inches for a smaller area towards the barn. The 5-inch sub-main drains 50 acres, and has about 50 rods of 4-inch branches, several of 3-inch branches, and 2-inch laterals to make up about two miles of drains on the 50 acres, which, after several years' experience, appears to be all that is required. The 4-inch sub-main has three-fourths of a mile of 2-inch laterals, and drains about 20 acres. The laterals on these sub-mains have an average fall of about 2 inches in 100 feet.

The 6-inch main receives several branches below the well, and it now serves as the outlet for the drainage of 125 acres, and Mr. Wood informs me that he is well satisfied with its efficiency. After very heavy rainfalls that occur several times a year, in seasons of more than average precipitation, this drain runs full for three or four days at a time, but it does not fail to remove the water so that the land can be worked in a few hours after the heaviest

rain. For the past year (1889) this drain, although closely watched, has not been known to run full.

The annual rainfall at Lansing, 12 miles from Mason, is about 35 inches, and three or four rainfalls of one inch and over may occur during the year.

Mr. Wood has another 6-inch drain, 70 rods long, with a fall of about 4 inches in 100 feet, that drains 75 acres; it has 40 rods of 5-inch branches, 140 rods of 4-inch branches, and in all about 5 miles of laterals, with a fall of $\frac{1}{8}$ to $\frac{1}{4}$ inch to the rod. The mains on this farm have proved satisfactory, and Mr. Wood thinks larger tiles would have no advantages to offset their greater cost.

The outlet for the first-mentioned 6-inch drain was an open ditch across some marsh lands, but this has finally been replaced by tiles to connect with mains for the drainage of a large adjoining tract of marsh and upland. This was in fact the beginning of an extensive system of drains for a drainage basin of more than 2,000 acres, of which about 500 acres is marsh land, along the borders of a creek, and the entire work was carried out under the direction of Mr. Wood, who was recognized by his neighbors as an expert from his success in draining his own farm.

As an illustration of what may be accomplished through the influence of a single farmer, some details of this draining enterprise will be given. The drainage basin included part of two towns, and "twenty per cent. of the total cost was levied on the townships intersected by the drains, 10 per cent. being for improvement of roads, and 10 per cent. for sanitary improvement. The rest of the expense was met by the farmers directly interested, each being assessed in proportion to calculated benefits."

The system of "public mains" is now completed, and the number of rods of each size of tiles is as follows: 3-inch, 293; 4-inch, 456; 5-inch, 556; 6-inch, 617; 8-inch, 740; 10-inch, 523; 12-inch, 254; 18-inch, 45; 20-inch, 15; or, in all, nearly eleven miles. "The total cost of the drains is $7,218.13, or $3.60 per acre for 2,000 acres. An addition to the present outlet is needed, which will bring the total cost per acre to less than $4.00 for outlets to the farms of this basin."

The drains that are to serve as outlets or mains to the different farms are 3, 4, 5, or 6-inch tiles, according to the area to be drained. Each farmer is now provided with a suitable outlet for the drainage of his farm, and when this is accomplished the repulsive looking marshes of the locality will be transformed into valuable farming land. On his own farm Mr. Wood claims that he has realized in a single year, in increase of crops, 25 per cent. on the cost of draining, and his neighbors are fully satisfied that they may profitably follow his example.

These results of experience in regard to the size of tiles required for the drainage of a given area seem to agree fully with the suggestions that have been made in regard to the influence of the various checks to the flow of water through a drained soil in determining its gradual transmission to the tiles. When drains are laid with the care that should always be exercised with reference to every possible cause of failure no harm will result from the rising of the surface of the water-table above the top of the drains so that they run full for several days.

A word of caution in regard to a common fault in the construction of drains may not be out of place in this connection. It is a popular notion that when the fall or slope of a line of tiles is considerable, less care is required in laying them than when there is but little fall. This is, however, a mistake, from the fact that the pressure from the head of water in the drain, where the fall is rapid and the tiles are running full, will tend to force out the water at the joints and cause a washout and displacement of the tiles. This is a frequent cause of obstruction in drains where least suspected, as water running outside of the tiles will undermine them and cause an obstruction, by their change of position, where the surface indications of the fault are not readily detected, particularly on land under cultiva-

tion. The obvious remedy for this difficulty is to lay the tiles with close joints and pack the soil firmly around them when the drain is laid. Close-fitting joints and the thorough packing of the earth around the tiles are quite as essential on lines of rapid descent as where the fall is but slight.

In deciding, then, upon the size of tiles required for a given area, it will be seen that no arbitrary rule can be laid down that is applicable to even average conditions; but it is evident that the annual rainfall need not be considered, and that it will not be advisable to attempt to remove the surplus water of heavy rains in twenty-four hours, or to provide for the rapid removal of the extraordinary rainfalls that rarely occur. On the whole it will be found better economy, in most cases, to lay tiles that will run full for several days than to pay for the larger sizes that have a capacity considerably in excess of the average demands that will be made on them.

**Kind of Tiles.** — Round tiles should alone be used, as they have many advantages over any other forms. The ends of tiles are not always at right angles to the axis, and when placed in the trench they may not at first form a close fitting joint with the tile already laid, but with round tiles by rotating the tile on its axis, a satisfactory joint can usually be obtained. It is desirable to have the ends of the tiles in actual contact on all sides, and this is more readily secured with round tiles. Moreover, in using the draining scoops to make a bed for the tiles, it is easier to get a true grade, by making a groove to fit a round tile, than can be made for any other form.

**Collars.** — Collars, or rings, to cover the joints of tiles should never be used, even in quicksand, where they are thought to be necessary, as they increase the expense without doing any good in a properly laid drain. The only purpose they can serve is to cover up imperfect work, as it is almost impossible to secure perfect joints when the collar covers the point of contact between the tiles.

Collars and tiles never receive precisely the same amount of heat in different parts of the kiln, and this occasions differences in shrinkage, so that collars that will fit tiles closely are seldom found, and a loose collar over a joint is worse than useless.

**Boards in Drains.** — Boards in the bottom of a drain to support the tiles in soft land of any kind, do more harm than good, as they cannot be kept in place, and materially increase the difficulties of construction. They are frequently recommended in quicksand, but much better work can be done without them in all cases.

**Protection of Joints.** — A piece of firm sod cut thin, about three or four inches wide, and long enough to reach rather more than half way around the tiles, forms a good protection to the joints. On the whole, however, the best and cheapest covering of the joints is tarred roofing-paper, in strips two inches wide and cut in lengths rather more than one-half the circumference of the tiles. For convenience, efficiency, and the economy of labor, it cannot fail to give satisfaction.

**How to Lay Tile Drains.** — There are perhaps no special improvements on the farm that should be of a permanent character, in which so many radical mistakes are made as in draining. From an extended experience in tile draining in a great variety of soils and under almost all possible conditions, I am satisfied that the directions usually given for the laying of tiles are impracticable under average conditions, and that even skilled workmen in attempting to follow them cannot secure the best results.

After many experiments I finally planned a method of laying tiles that has proved convenient in practice, and accurate and economical in its results. It has been applied in some extended draining operations that could not have been carried out in a satisfactory manner, at a reasonable expense, under former methods. If this plan of laying tiles is strictly

followed, drains can be laid by the average farmer with the ordinary hands employed on the farm without danger of failure from imperfect work; and what is also of importance, the draining of the farm can be done as labor can best be spared for the purpose.

A permanent and efficient drain can only be made by keeping in mind certain fundamental conditions that must be secured in the prosecution of the work. The tiles must be on a true grade without any vertical undulations ; the ends of the tiles must fit together closely, with proper protection to prevent silt from entering from the upper side ; and with a fall of but six inches, or less, in 100 feet, each foot of the drain must have its due and proper proportion. To secure these conditions, it is evident that there must be some arrangement for determining the position of every tile with some degree of accuracy.

The boning rods. A levels, and other devices described in the books on draining, for getting the grade of the drain, are not only inconvenient to use, but they cannot be relied on to establish the grade with the accuracy required where there is but little fall.

The usual directions given to prepare the whole length of the trench for the tiles and then begin at the upper end to lay them, will be found impracticable on a large proportion of the land that needs draining, and unless the bottom of the trench is hard and dry, perfect work cannot be done in that way. In my own experience I have seen but very few ditches where it was possible to lay the tiles from the upper end towards the outlet and make a good drain. The practice of beginning at the outlet and finishing the drain as the work progressed, first suggested by myself, has many advantages, and when once fairly tried no other method will be thought of.

By beginning at the outlet the drain as laid is working effectively to lower the water table, and thus facilitates the work above ; and it is not necessary to stand or walk on the bottom of the finished trench, while all conditions are favorable for securing accuracy in every part of the work.

The only objection to this method that can be raised, is the danger that silt in the form of mud or fragments of earth, may be washed into the drain by running water. Practically, this is hardly worth considering, as with reasonable care this need not occur and careless hands have no business to engage in the work of tile laying.

A convenient, and apparently the only safe method of placing the tiles on a true grade, is to stretch a line above the ditch parallel to the proposed course of the drain, and measure from it to determine the proper position of the tiles as they are laid. This had been suggested by Judge French in his work on draining, but from the practical difficulties in the way of the adjustment of the line and keeping it in position, it did not come into general use, although it must be admitted that a line to measure from is essential to secure accuracy in the grade.

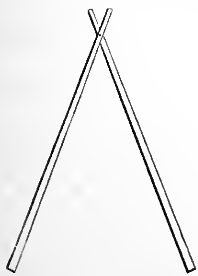

Fig. 1.

This led me to invent the following simple and efficient plan for securing the line so that it can be readily adjusted and kept in place. Two strips of light one-inch board, about 6 or 6½ feet long, and 2½ to 3 inches wide, are fastened together by a small carriage bolt about six inches from one end, as represented in Fig. 1, forming what, for convenience, may be called shears. The lower end of the strips should be square, to prevent settling into the soil when in place.

When the trench for the tiles has been dug to within about nine to twelve inches of the bottom, two of these shears are placed astride it at a distance from each other of from four to eight rods, or even more. The top of the shears should be exactly over the middle of the ditch, and the height can be readily adjusted by bringing the legs closer together, or spreading them apart, and a line is then drawn from one to the other, as represented in Fig. 2.

The line should be small and strong, like a mason's line, and where it passes over the fork at the upper end of the shears, it should be wound once around one of the short arms to prevent slipping, and the ends of the line are then fastened to a small stake near the edge of the ditch. The pegs or stakes to which the line is fastened should be five or six feet from the foot of the shears. If they are nearer the foot of the shears

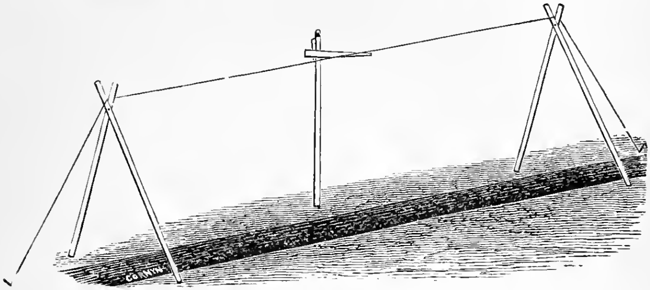

Fig. 2.

than the height of the line above the ground, the line will probably be broken, between the shears and the peg, from the leverage resulting from its position when the required tension is applied to make the line straight.

A large line will sag, and the smaller it is the better, provided it has the required strength. A new line will stretch and sag more or less, and it must be constantly watched or a sag in the drain may be the result.

When the shears are several rods apart even the smallest line will need a support, and this is effected by "gauge stakes," of the form represented in Fig. 3, which may be placed at convenient distances along the line of the ditch, as shown in Fig. 2, to prevent any sagging of the line.

A long fork-handle may be used for the vertical part of this gauge, which should be of hard wood, about 6 feet long, and $1\frac{3}{8}$ inches in diameter. The lower end should have a sharp iron point, which a blacksmith will make from a piece of gas pipe, and the upper end has an iron band to prevent splitting when driven into the ground.

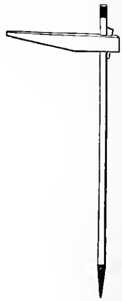

Fig. 3.

The horizontal arm, about 26 inches long, and 2 by $2\frac{1}{2}$ inches square at the end through which the vertical rod passes, is tapered to three-fourths of an inch square at the opposite end for the sake of lightness. A rivet, not shown in the cut, should be put through the base of the arm, back of the key, to prevent splitting. When the vertical rod is driven into the ground near the edge of the ditch the horizontal arm is slid up under the line until the sag is corrected, when it is secured by the key which clamps it to the rod.

When laying tiles it will be found convenient to adjust the line seven feet above and parallel to the desired grade, and then use a seven-foot measuring-rod to determine the depth of cut below the line for the bed of the tile.

When working with a seven-foot measuring-rod, if all but the last foot of excavation is made before the line is put up, it will not be in the way, as a man can work under it when standing in the ditch. If the tiles are laid deeper than four feet a longer measuring-rod may be used.

**Tools for Tile Draining.**—In works on draining two forms of draining scoops are figured, called the "push scoop," Fig. 4, and the "pull scoop," Fig. 5, and directions are given to stand on the surface, near the edge of the ditch, and with these tools prepare a bed for the tiles. A tile-hook is then used to lower the tile and place them in the trench. A trial of this method of tile-laying will soon demonstrate its impracticability, as a good drain cannot be made in that way. The "pull" and the "push" scoops are awkward tools to manage under any conditions: but when a person attempts to use them, at long range, in the bottom of a three-foot ditch, when standing on the surface of the ground, they are found to be useless. The push scoop, when loaded, is heavy on the point, and rolls in the hands, while the pull scoop trembles and springs when it meets with an obstruction, and from the position of the shank at the end of the blade they are both of them weak, and easily broken.

FIG. 4.

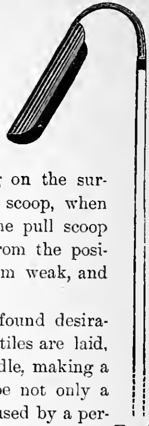

FIG. 5.

As a scoop having the form of the lower half of the tile was found desirable for making a groove in the bottom of the ditch in which the tiles are laid, after a number of experiments I changed the position of the handle, making a scoop of the form represented in Fig. 6, which has proved to be not only a useful but an indispensable implement in tile laying. As it is used by a person standing in the ditch it has a shorter, lighter handle, and on the whole is a light, well-balanced tool, with the push and pull characters combined, and without any of the disadvantages of either of the old forms. Three or four sizes of this scoop, adapted to the different sizes of tiles, will be found convenient, with handles (not represented full length in the figure) from 4½ to 6 feet long, and about the size of a hoe handle or the lower part of the stale of a common hay rake, so that it is light and easily managed.

FIG. 6.

A blacksmith will readily change the position of the shank on the blade of the old style of scoops and convert them into the improved form, but the handles had better be replaced with smaller, shorter ones that are better adapted to the work required of them. Useful scoops can also be made, from an old saw blade if not too thick, or a thin well-worn shovel blade, at a trifling expense.

The blade of the scoop should be 12 to 14 inches long and curved to fit the outside of the tile that is to be laid with it, and in width it should be a little more than one-third and less than one-half of the circumference of the tile. These scoops will soon pay for themselves in facilitating the work, and a good job of tile laying cannot be done without them.

An ordinary long-handled pointed shovel may be converted into a heavier and stronger scoop, that will be found useful in cleaning out ditches where the common spade or shovel cannot be used, by cutting off the sides of the blade to make it about 8 inches wide and then curving it to fit the outside of a 6-inch tile. This will be found a handy tool for clearing out the bottom of the trench to within 3 or 4 inches of the true grade, when the Miles draining scoop, Fig. 6, for laying the tile, can be used to advantage.

In making the last foot of excavation in the ditch draining spades may be used, as they economize labor by diminishing the width of the ditch, and consequently the amount of earth to be moved.

**Draining Spades.**—A draining-spade has a longer blade than the common spade, and it is more tapering and has the point rounded to correspond to the form of the tile.

The sizes that will be found most useful are the 3, 4, and 6-inch, according to the tile they are fitted to prepare for.

For the excavation to within 9 to 12 inches of the bottom of the ditch the ordinary form of spade or shovel, with a common pick, if the earth is hard, will be the best; but it should be remarked that the long-handled spades or shovels that are often used are not desirable.

A width of 18 inches at the top will be sufficient for the trench of a four-foot drain, and 16 inches for a three-foot, and the sides should be cut sloping so that the width at the bottom is from 4 to 9 inches, according to the size of the tile. The aim should be to make the trench as narrow as it can be and allow room to work, to save expense in the amount of earth moved, but it will not be advisable to make the bottom of the trench narrower than 4 or 5 inches for a two-inch tile, or 8 to 9 inches for a 6-inch tile; but these dimensions will be ample under all ordinary conditions.

The excavation of the first two feet of the trench for tiles is a matter of no little importance. If the trench is not straight at the top and its sides kept reasonably true, it will result in constant annoyance when the tiles are being laid, as close-fitting joints cannot readily be secured in a crooked ditch.

The plow and sub-soil plow are frequently used to loosen the soil at the upper part of the ditch, particularly for the larger sizes of tiles, and this may be a labor-saving operation, provided the work is done so that the above conditions are secured. It may be better on the whole to use the spade on the start and make the ditch as narrow as practicable, and save labor by economy in the amount of earth moved.

**Laying the Tiles.** — Under this head must be included the excavation of the last 6 to 8 inches of the trench, for this should never be done until the tiles are ready to be laid. Let us, then, suppose, for example, that a ditch of proper form has been dug with the exception of the last 6 to 8 inches; that the earth has all been thrown out on one side of the trench, and that tiles have been distributed on the other side so that they are in reach of the person standing in the trench who is to lay them. Sods are also provided to cover the joints, or still better, a bundle of strips of tarred, or roofing, paper of the proper size for the same purpose.

Beginning at the outlet, one of the shears is placed over the point where the first tile is to be laid, and the other at a convenient distance of several rods from it, so that the line when adjusted is over the middle of the ditch and 7 feet above the grade on which the tiles are to be laid, as in Fig. 2. One man with a draining spade now stands in the ditch facing the outlet and cuts down slices of the earth to be moved, taking care as he works backwards to make a straight trench for the tiles and leave some three inches at the bottom in which the tiles are to be bedded. Another man, facing the first, removes the earth loosened by the spade with the stout scoop described above.

The progress of the work should now depend on the character of the bottom of the trench and the water running in it. If it is hard and firm, with little water running, the excavation may be made several rods in advance of the tile laying, by a separate gang, the measuring rod being frequently used, so that about three or four inches of earth remains for the next operation, but this work should not be allowed to be many rods in advance of the tile-layers.

If the bottom of the ditch is soft, so that mud is made by treading, or a considerable amount of water is running, but one gang can work to advantage, and the excavation of the last six inches of the drain should only be made for a distance of three or four feet before laying the tiles.

To lay the tiles, cut a straight groove in the bottom of the trench with the draining scoop, gauging the depth accurately with the measuring rod. Put the first three tiles in place, with close-fitting joints, over which strips of the tarred paper are placed. and cover all

with four or five inches of earth, care being taken not to displace the tiles or the covering of the joints.

The man who lays the tiles now stands on this earth over the tiles already laid, as in Fig. 7, and with the scoop prepares the bed for two or three tiles more, or as far as he can conveniently reach. The tiles are then laid, the joints protected and covered with earth as before. By selecting earth for this purpose that is not sticky, the tile-layer has a firm and dry platform to work on, and the water running in the ditch passes through the tiles under his feet, and he has not only a comfortable place to work, but he compacts the earth around the tiles by standing upon it, which is also an advantage.

FIG. 7.

In using the draining scoop, if the earth is too hard to be easily moved, or if there are small stones or other obstructions, the man with the draining spade should be in supporting distance to chip out the line of the groove and facilitate the working of the scoop. If the bottom of the ditch is soft, and water is running, the tiles should be laid as fast as the excavation is made, so that the feet of both workmen will be at least six to eight inches or more above the bed of the tiles.

With clear ideas of the object aimed at, and the exercise of a little judgment in planning the details of the work, it will not be found necessary to stand or walk on the last three inches of the bottom of the trench in which the tiles are laid; and the work, under such conditions, can be done more rapidly and with greater comfort, and, what is also quite as important, mud is not made by treading in the ditch to wash into the tiles. Two men working in this way can help each other, and they soon learn to make every motion effective.

The proprietor, as superintendent, will find it for his interest to manage the measuring rod and gauge the position of each tile, especially when there is but little fall, or, if he prefers to lay the tiles himself, a level-headed boy may use the measuring rod to advantage. Care must always be taken to measure from the line in a vertical direction, which can readily be accomplished by holding the measuring rod loosely between the thumb and fingers near its top, so that it will serve as a plumb to give the proper direction for measuring; and a frequent inspection of the line should be made to see that it does not sag, especially if it is a new one, or an old one that has been wet.

Another matter of importance may here be mentioned; the cut with the draining scoop should never be made lower than the line on which the bottom of the tile is to be laid. This is a frequent cause of irregularities in the slope of the tiles, as it is almost impossible to fill in with earth when the cut is too deep, so that the tiles will be in line when they receive the full pressure from the earth when the ditch is finished.

In case the work is suspended by rains, or, when leaving the ditch over night, a firm sod should be laid over the end of the last tile, grass side down, to prevent silt or other causes of obstruction from washing into the tile. The line used in laying tiles should be kept dry, and for this reason it will be advisable to take it in at night, or the moisture absorbed by it will cause it to stretch and be a source of annoyance in the morning of the following day.

**Adjusting the Line.** — When putting up the line to begin work, one of the shears is brought forward and adjusted at its proper height by means of the measuring rod over the end of the last tile laid, and the other at some convenient distance further up the drain. If grade stakes have been placed at intervals along the line of the ditch, with the required cut marked on them, the last shears may be placed over one of them so that the proper height can be determined.

With a slight fall in the drain, however, this measurement from a grade stake should not be regarded as final, as it must be known with certainty that the line, when adjusted, has a slope towards the outlet of the drain. The only instrument required for this verification of the grade is an ordinary mason's or builder's spirit level, which may be bought at the hardware stores for one dollar.

When the fall is considerable, the level may be held under the line with sufficient accuracy to show that it has a slope in the right direction; but when the fall is less than three or four inches in 100 feet, its position with reference to the proper fall should be determined with greater accuracy.

To do this, provide two strips of board for stakes about 2 or 3 inches wide and $3\frac{1}{2}$ to 4 feet long, the upper ends of which are square and the lower ends sharpened. At a point opposite the middle of the line, and back about twenty feet from the edge of the ditch, these stakes are driven into the ground about twenty inches apart, so that the level, when resting on them, is parallel to the line of the drain. By carefully driving one or the other of the two stakes the bubble of the level may be brought to its proper position in the center, and the instrument is then, as its name indicates, level. Now stand two or three feet back of the level and bring the eye in range with the top of it and the line over the ditch, and the true slope of the line will be readily seen. The line must of course be tightly drawn and supported by the gauge stakes so that it is perfectly straight.

By this method of determining the slope of the line from which the depth of the drain is measured I have laid tiles accurately on a fall of one-half inch in 100 feet, and have found it more convenient than an engineer's level for the purpose. In fact, when laying tiles on a slight fall, I always keep the builders' level adjusted opposite the middle of the line, and a glance at any time is sufficient to show that the line is in its proper place.

**Quicksand.** — Tiles, when well laid in quicksand, form efficient drains that are no more liable to obstruction than similar drains in heavy soils; in fact, drained quicksand seems to furnish as stable a support for tiles as any other soil. Drains that I laid fifteen to twenty years ago, to the depth of five feet, the last two to two and one-half feet being quicksand, have not failed in a single instance, and all are working perfectly at the present time.

From what has already been said the use of boards or collars to keep tiles in place in quicksand must be avoided, as they only add to the difficulties of the work without any compensating advantages.

In many localities in the drift formation there are frequent beds or pockets of quicksand within three or four feet of the surface that are serious obstacles to deep draining under the old methods of tile laying, but which, by proper management, may be thoroughly drained without interfering, to any extent, with the progress of the work, and a detailed description will therefore be given of the method of laying tiles in quicksand, which, in my own experience, has proved the most satisfactory.

One of the first essentials of success is to lay the drains in the summer months when there is comparatively little surplus water in the soil. When the tiles are laid to a point where quicksand is found, the end of the last tile is covered with a firm sod, to prevent the sand from running into the drain, and work is suspended until the water-table is lowered to the level of the tiles. This may require several days, and if a heavy rain occurs, time must be given for the surplus water to be carried off by the drain before work is resumed. It is evident that a head of water in the soil, above the line of the tiles, will force the quicksand into the ditch as fast as it is taken out with the scoop, and no real progress in the work can be made.

When digging the trench it is likewise important that the excavation is not allowed to extend below the surface of the quicksand, until the water-table is lowered by the drain, and everything is made ready for laying the tiles. Before the water-table is lowered, if quicksand is thrown out of the ditch, it not only runs in at once from the sides, as already suggested, but the banks of the ditch are undermined and they cave in and fill it up. When this earth is thrown out, if the quicksand is still further disturbed by tramping through it, or attempts to throw it out, the process of undermining the banks is extended, additional caves occur and large amounts of earth are moved at a needless expense, and serious annoyance in many ways without making any real progress in laying the drain.

In my first experience in laying tiles in quicksand it was thought necessary to curb the sides of the ditch with planks or boards to keep the quicksand out and prevent the caving of the banks, but this was an expensive and not always satisfactory operation; and it was found that the exercise of a little patience, to allow the water-table to subside, by drainage through the tiles already laid, was a cheaper and better plan. When the cut is through two feet in depth of quicksand, curbing is now seldom required, and more rapid progress in the work is the result. When draining quicksand the old adage, "make haste slowly," is a good one to follow.

When the head of water in the banks of the ditch has been disposed of by the lowering of the water-table to the level of the drain, the process of laying the tiles is as follows, care being constantly taken to disturb the quicksand as little as possible by any sudden jar or movement in contact with it. The walking or standing in the ditch when the feet settle down into the sand should be strictly prohibited.

The man who lays the tiles and uses the draining scoop has, of course, a dry and stable platform to work from, as he stands on the layer of earth which covers the tiles already laid. If it is found desirable to have a second man in the ditch to aid in the work of excavation and tile laying, a platform must be provided for him, to keep his feet from sinking into the sand, consisting of a piece of two-by-eight, or two-by-ten-inch joist about six or eight feet long, which is laid on the quicksand in bottom of the ditch. For convenience in moving it, a hole may be bored near the upper end, in which is fastened a piece of stout rope, and the unattached end is laid over the sides of the ditch. When the tiles are laid nearly to the end of this plank it can be pulled back a few feet by means of the rope, and the process repeated.

The quicksand can be readily moved with the scoops, and spades or shovels must not be used. In making the excavation through the quicksand with the scoop great care and judgment are required, and the work must be done with as few and simple motions as possible. If the handle of the scoop is depressed when the blade is in the sand, the air cannot readily enter under the elevated point of the blade, and sand runs in to fill the space, and when the scoop with its load is lifted by a sudden motion, the ditch will be as full as before the scoopful was removed. By repeating this process the banks are undermined and cave in before any progress is made in deepening the excavation.

The correct method of using the scoop is to press it into the sand with a steady, continuous motion, then carefully raise the hands to admit the air under the *heel* of the blade,

and lift the load vertically without any lateral movement, leaving a groove in the sand of the size and form of the blade of the scoop. If the cut is not deep enough the process is repeated until the desired grade is reached. Deep single cuts should not be attempted, as a succession of slices will best accomplish the work.

In measuring from the line to determine the grade, the measuring rod must not be allowed to stand upon the bed made for the tile. It will not answer to lose sight of the fact that the equilibrium of the sand is easily overcome by a jar from moving the feet, by a trembling movement of the scoop when in contact with it, or by the sudden pressure of the measuring rod, and that any slight disturbance of the sand will cause it to run and fill the excavation that may have been made. Success in laying tiles in quicksand will depend to a great extent on the avoidance of all such exciting causes of disturbance, and the lifting of the sand in the careful manner described.

When the bed is prepared for one or two tiles, according to circumstances, they should be laid at once with great care, the joints protected with tarred paper and then covered with soil that is not lumpy (that from the surface is best), to a point a little above the wet quicksand in the sides of the ditch. This will furnish a firm standing place for the tile-layer, and the same process is again repeated.

By confining the work to such short sections of the ditch after quicksand is reached the danger of undermining the banks is reduced to a minimum, and the filling in a little above the top of the quicksand, as the tiles are laid, supports the banks and aids in preventing them from caving in.

The manner in which the first filling of earth on the tiles is done is a matter of importance in securing the integrity of the drain. A sudden fall of earth, in mass, from a shovel, for a distance of but a few inches will set the sand in motion, and may displace the tiles already laid. The filling of one side of the ditch faster than the other is to be avoided, as the danger of displacing the tile arises from any change in the equilibrium of the sand, or in giving it vent, so that it can run. When the quicksand is confined it becomes stable, and the tile will remain in place under heavy pressure.

After the first covering of earth is placed on the tiles it is well, as a matter of precaution, to measure again from the line to see that the last tile is in its proper place.

It is, of course, important that the quicksand is not allowed to run into the tiles where it may accumulate and cause an obstruction, especially where the fall is slight. With reasonable care, however, in every part of the work, and the protection of a sod over the end of the tile, when it is left even for a short time, such accidents should not occur.

**Tile Hammer.** — Most of the large tile factories now make curves and elbows for changing the directions of drains, and T and Y branches for junctions, for almost all sizes of tiles. These are convenient, but, in their absence, satisfactory junctions can readily be made with a tile hammer, which is almost an indispensable implement in tile laying.

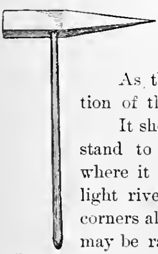

Fig. 8.

As these hammers are not kept in stock at the hardware stores, a description of the most convenient form, Fig. 8, will be given.

It should be made of the best steel, with a cold chisel temper, so that it will stand to cut the hardest tiles. In size about 1 inch by $\frac{7}{8}$ at the largest part, where it receives the handle, and $4\frac{1}{2}$ to 5 inches long, or about as heavy as a light riveting hammer. The sides and face should be flat, with sharp, square corners all round. The handle of tough, hard wood, about 10 or 12 inches long, may be rather slender towards the hammer-head, so that it will spring slightly when a hard blow is struck.

With the point of the hammer a hole may be cut of suitable size and form, in the side of a tile, and the end of another fitted over it to make a Y-shaped junction. With a little

practice the tiles may be cut to make close fitting joints at junctions, or the end of a tile may be cut obliquely to change the direction of a drain when required. When the point of the hammer is dulled by use it may be sharpened on a grindstone. The point must end in a bevel on all sides, like the edge of a cold chisel, for if too slender it is liable to break.

**Outlets of Tile Drains.** — The outlet of a drain, or system of drains, should always be protected by a wall of masonry, laid in cement, and resting on a foundation extending below the action of frost, and the tile should be covered with a grating to keep out vermin.

When the outlet of a tile drain terminates in an open ditch, frequent inspection is required, as it must be kept clear and free from obstructions to the discharge of water from the tiles.

## HIGH FARMING.

Many of the suggestions that are made in regard to improved methods in agriculture seem to be based on the assumption that farming pays best when the largest possible crops are grown, and all processes of the farm are conducted on an intensive system.

That this notion is widely prevalent is apparent from the tacit endorsement it receives from agricultural societies, and would-be "promoters of agricultural progress," in the offer of large premiums for the largest yield of different crops. This serves as an advertising card, not only for the originator of the premium, but also for manufacturers of commercial manures, who, with an eye solely to business, add to the amount of the premium, provided always the largest yield is produced where their special brand of fertilizers has been used.

Practical farmers should not, however, be misled by such offers, or the laudatory comments of the press, in notices of remarkable yields which have been obtained, on a small scale, regardless of expense.

When premiums are awarded for crops or other products that have cost considerably more than their value for any purpose, it may be well to inquire into the general tendency and results of intensive farming, to ascertain to what extent it can be profitably practiced by American farmers.

High, or intensive, farming may be defined as the growing of large crops with purchased fertility in the form of manures or cattle food, from sources outside of the farm. This may be carried to the extent of supplying all of the elements of fertility required by crops without drawing upon the soil, which becomes, in effect, a factory for the manufacture of plant food from imported raw materials.

Attention has already been called to the paramount importance of the stores of fertility in the soil, in enabling the American farmer to successfully meet foreign competition in farm products, and the question arises as to the extent he may safely waive this element of advantage, in the management of his farm, by practicing high farming.

It will, perhaps, be generally admitted as a self-evident proposition that the best system of agriculture for the average farmer is the one that will yield the largest net returns for the capital invested and the labor expended, without impairing the future productiveness of the soil.

The practice of mixed husbandry, in which there is a systematic rotation of crops, and a large proportion of the produce of the farm is disposed of in the form of animal products, leaving a valuable manurial residue to be returned to the soil, will, undoubtedly, be regarded by the majority of farmers as, on the whole, the most profitable for them to follow. This, beyond question, may be termed good farming, but, even when carried out under a thorough system that provides for the preservation and judicious application of all of the manure made on the farm, it cannot be called high farming, as production is limited to the resources of the farm itself, and much larger crops may be obtained by intensive methods in which manures, in one form or another, are largely purchased.

What results, then, may reasonably be expected from the liberal application of purchased manures? Will the immediate tendency be to diminish the cost of production and widen the margin of profit, and thus serve as a remedy for low prices?

In answering these questions, attention must be called to the facts presented in discussing the subject of manures, that when manures are applied to the soil they cannot be wholly accounted for in the increase of crops produced, and that, the larger the amount of manure applied, the smaller will be the proportion utilized in the increase of the crop. This is shown clearly in the summary of experiments given in Table 2, and additional data will likewise be found in Tables 18 and 19. The pertinence of experimental results like these in discussing the principles involved in intensive farming must be obvious.

From the results of experiments like these it must be evident that there is a limit beyond which the application of manure may fail to give a remunerative return in the increase of crop produced, and this limit will, of course, be sooner reached when the produce commands but a low price in the market.

It will be generally admitted that a maximum yield of crops can only be secured by the liberal application of manures, but it is not as well known that the final increment of such crops cannot be expected to equal in value the manures required to produce them. This is high farming, but can it be recommended as a profitable system for farmers to practice.

The experiments with wheat and barley at Rothamsted, which are summarized in Table 27, furnish additional evidence in regard to the economy of high manuring. In comparing the figures of this table it should be remembered that the nitrogenous manures gave the best results with the cereals, and in these experiments the ammonia-salts were applied in different amounts to determine the extent to which they might be profitably used.

TABLE 27.

*Experiment with wheat and barley at Rothamsted.*

| History of Plots. | Average annual yield per acre. | |
|---|---|---|
| | Grain. | Straw. |
| *Wheat every year, 36 years, 1852--1887.* | Bushels. | Cwts. |
| Unmanured continuously, . . . . . . . . . . . . . | 13 | 11 |
| Complex mineral manure alone, . . . . . . . . . . . | 15⅛ | 12⅝ |
| " " " and 200 lbs. ammonia salts, . . . . . . | 24 | 21⅞ |
| " " " " 400 " " " . . . . . | 32¾ | 33¼ |
| " " " " 600 " " " . . . . . | 36½ | 40¼ |
| *Barley every year, 6 years, 1852--1887.* | | |
| Superphosphate alone, . . . . . . . . . . . . . | 31⅝ | 16½ |
| " and 200 lbs. ammonia-salts, . . . . . . . . . | 45½ | 28⅜ |
| " " 400 lbs. " " . . . . . . . . . | 49⅝ | 34 |

The manures in these experiments were applied every year, with the purpose of obtaining maximum yields in the case of the most liberal supplies of manure, and the results furnish good examples of high farming.

When the complex mineral manure alone was applied to wheat, the average increase of crops for 36 years was but 2⅛ bushels over the unmanured plot. The addition of 200 pounds of ammonia-salts now gave a further increase of nearly nine bushels per acre, and a second 200 pounds (400 pounds in all), gave nearly the same amount of increase, while for the third 200 pounds (making 600 pounds in all), the increase of grain was considerably less than half as much, or only 3¾ bushels.

The 400 pounds of ammonia-salts apparently approximated closely to the limits of the profitable application of the fertilizer, when wheat is worth a little more than one dollar per bushel, but even then the value of the increase of crop from the last 200 pounds of the manure would be much less than the cost of production.

From the average results for 36 years, under the conditions of this experiment, it evidently paid better to raise 32¾ bushels of wheat per acre than to increase the yield by high manuring to 36½ bushels.

It will be noticed that while the increase of straw from the last 200 pounds of the manure was likewise less than with the previous amounts, there was, however, a large proportion of straw to grain.

With barley the results are quite as striking, the first 200 pounds of ammonia-salts yielding an average increase of nearly 14 bushels of grain, while the last 200 pounds gave an increase of but little more than 4 bushels. It will also be seen that the last 200 pounds of the manure, as in the case with wheat, gave a larger proportion of straw in the increase than the first 200 pounds. "It was, in fact, so evident from the bulk and the laying of the crop that 400 pounds of ammonia-salts was an excessive application, that after its use for 6 years the experiment was abandoned."

Here again it is obvious that it might pay to grow 45½ bushels of barley per acre, while a yield of 49⅝ bushels would be grown at a loss.

In the experiments with the *mixed herbage of permanent meadow* at Rothamsted, there are the same indications of a diminished increase in the crops, from each increment of the manure applied, as will be seen in Table 28, where the effects of nitrate of soda by itself, and with a liberal supply of mixed mineral manures, are given in the average yield of hay per acre for periods of eight, ten, and eighteen years.

TABLE 28.

*Average yield of hay per acre on selected plots of permanent meadow, for periods of eight and ten years, and for the total period of eighteen years.*

| Periods. | 1<br>Plot 3, without manure. | 2<br>Plot 17, 275 lbs. nitrate of soda. | 3<br>Plot 15, 550 lbs. nitrate of soda. | 4<br>Increase of hay from first 275 lbs. of nitrate of soda. | 5<br>Increase of hay from second 275 lbs. of nitrate of soda. | 6<br>Plot 16, mineral manures with 275 lbs. of nitrate of soda. | 7<br>Plot 14, mineral manures with 550 lbs. of nitrate of soda. | 8<br>Increase of hay from first 275 lbs. of nitrate of soda with mineral manure. | 9<br>Increase of hay from second 275 lbs. of nitrate of soda with mineral manures. |
|---|---|---|---|---|---|---|---|---|---|
| | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| 1st period 8 years, 1858–1865, | 2492 | 3837 | 4038 | 1345 | 201 | 5058 | 5944 | 2566 | 886 |
| 2d period 10 years, 1866–1875, | 2236 | 3755 | 3913 | 1519 | 158 | 5332 | 6777 | 3096 | 1445 |
| Total period of eighteen years 1858–1875, . . . . . | 2350 | 3792 | 3968 | 1442 | 176 | 5210 | 6407 | 2860 | 1197 |

Where the nitrate of soda was applied alone it appears (column 4) that the first 275 pounds gave, on the average, an increase in hay of 1,345 pounds for the first period; 1,519 pounds for the second period; and 1,442 pounds for the total period of 18 years: while the second 275 pounds (column 5) gave an average increase of but 201 pounds for the first period; 158 pounds for the second period; and 176 pounds for the total period, and the value of this increase must be considerably less than the cost of the manure required to produce it.

Where mixed mineral manures were applied there was not only a better absolute yield,

but a larger increase in yield from the manure; the first 275 pounds of nitrate of soda (column 8) giving an average annual increase in yield of 2,556 pounds of hay for the first period; 3,096 pounds for the second period; and 2,860 pounds in the total period of 18 years: while the second 275 pounds of nitrate (column 9) gave an average increase of but 886 pounds for the first period; 1,445 pounds for the second period; and 1,197 pounds for the total period of 18 years.

The profit that may be derived from the increase of crop produced by the second 275 pounds of nitrate applied must depend on the market value of the hay. With hay at $20.00 per ton the returns from the manure might yield a fair profit, but with hay at $12.00 per ton the increase in crop would not pay for the manure used in its production.

With high farming there is undoubtedly an increased cost of production, after passing a certain limit, which must vary with the conditions in each particular case, and higher prices must then be realized for the products obtained to make the practice profitable.

The same principle is applicable in the feeding of live stock, and other interests of the farm. An examination of the reports of fat stock shows, and experiments in feeding, when detailed reports are given, will show, that young animals give a larger return for feed consumed than older ones; and that animals in moderate, or store condition, require less feed to make a given amount of increase in live weight than those that are fat, or in high condition.

The extent to which the fattening process may be profitably carried must depend upon the market, as the last few pounds of increase that are made, beyond a certain limit, will cost more than the same number of pounds at an earlier stage in the process of feeding.

The influence of age and condition on the returns obtained for feed consumed will be sufficiently illustrated, for our present purpose, by an experiment which I made in 1866 with three pure-bred Essex sow pigs of the same litter. They were fed cows' milk exclusively, by means of a tin can with a spout and a rubber nipple, so that the milk consumed could be accurately determined without danger of waste. After a preliminary week with the same feed, to make them familiar with the new conditions, they were fed four weeks, with the following results, which are given in gross, without details for each individual.

At the beginning of the experiment the pigs were eleven days old, and the three weighed 14.5 pounds. At the close of the experiment they weighed 64 pounds, having made a gain of 49.5 pounds in four weeks. The milk consumed was 79.19 pounds the first week, 106.94 pounds the second week, 129.94 pounds the third week, and 141.81 pounds the fourth week; or a total of 457.88 pounds.

The percentage of gain in live weight for each week rapidly diminished at first, and then more slowly as they fattened, as follows: first week, 75.86 per cent.; second week, 52.92 per cent.; third week, 28.20 per cent.; fourth week, 28.00 per cent.; or an average weekly gain in live weight of 46.25 per cent. The milk consumed per week for each 1 pound of live weight, and the milk required to produce 1 pound of increase in live weight, for each week, can be readily compared in the following table:

Table 29.

*Milk consumed by three pigs, for each 1 pound of live weight, per week; and milk required to make 1 pound of increase in live weight for each week of the experiment.*

| | 1st Week. | 2d Week. | 3d Week. | 4th Week. | Average per week for four weeks. |
|---|---|---|---|---|---|
| | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| Average milk consumed for each 1 pound of live weight, . . . | 3.96 | 3.32 | 2.92 | 2.49 | 2.98 |
| Average milk required to make 1 pound of increase in live weight, | 7.20 | 7.92 | 11.81 | 10.13 | 9.25 |

It will be seen that the amount of milk consumed for a given live weight diminishes constantly to the end of the experiment, and that there is a corresponding increase in the amount of milk required to produce one pound of increase in live weight for each week. The larger amount of milk required to produce a pound of increase the third week than in the fourth week was readily accounted for at the time "by a slight derangement of the digestive organs the third week, as shown in a tendency to constipation." This was not sufficient to perceptibly diminish the amount of milk consumed, but a full return was not obtained for it. Had it not been for this derangement of the digestive organs about 8.90 pounds of milk should have been required to make a pound of increase the third week, and this correction would reduce the average for the four weeks to about 8.54 pounds.

The diminished consumption in proportion to weight and an increased cost of growth from week to week is, however, clearly evident, and, in connection with other evidence which might be cited, this appears to be a law of animal growth and development of practical importance in feeding.

Where high feeding is practiced in fattening animals, and the attempt is made to obtain the highest possible weights and the most perfect condition, as with prize animals and Christmas beef, a higher price must be obtained to make the transaction profitable than where a less intensive system is practiced. The same principle, undoubtedly, has an influence in feeding for other purposes, as in the production of milk and wool, and maximum results can only be obtained at the expense of an increased cost of production.

With low prices for farm products the economies of production cannot be neglected, and when maximum yields are obtained by intensive methods, under the stimulus of a prospective premium, it is well to inquire whether the product is worth what it has cost.

Is it not time to seriously consider the effect of offering premiums for mere quantity, regardless of quality or cost of production? Farmers must look upon the elements of their soil and the live stock of their farms as invested capital that must be managed with reference to the net profits that may be obtained without any sacrifice of the original investment.

Engineers are not satisfied with the engine that is capable of doing the largest amount of work, unless it has also other essential qualities, as the cost of the power obtained may exceed its efficient value for any useful purpose. The real problem they are trying to solve is, the means of completely utilizing the energy supplied in the form of fuel, and the engine that gives the largest return in efficient work for a given amount of fuel is now found to be the only form that can be profitably used in many of the industries.

The same principle must be applied in the solution of problems in agriculture; the farmer is directly interested in obtaining the largest net returns from the raw materials of production contained in his soil, and in the manures he applies to it, as these are, in effect, the utimate sources from which his income is derived.

In high farming a large immediate return may undoubtedly be secured, but if it involves a waste of the essential elements of production, it cannot be consistently urged as a system of general application under the present conditions of farm practice.

## BIOLOGICAL FACTORS IN FARMING.

In the applications of science to agriculture, chemistry, from its obvious relations to the phenomena of plant and animal growth and development, has received a prominent share of attention, and until within a few years past it has, in fact, been looked upon as representing the sum of knowledge required in a consistent system of agricultural science.

A large proportion of the problems in agriculture cannot, however, be solved by purely chemical methods, as there are other factors involved that are quite as essential to a thorough knowledge of the principles that underlie the practice of agriculture.

In the progressive development and classification of knowledge, resulting from the activity of modern methods of investigation, biology, or the science of life in its various manifestations and relations, is making rapid progress, and it is now being recognized as of the first importance in solving the many complex problems of practical interest to the farmer, from its immediate and direct relations to every department of farm economy.

The farmer is dealing with various forms of life in almost every operation and interest of the farm, and his success must largely depend upon the direction of affairs in strict conformity with the laws that regulate the activities of the living organisms which are really the dominant factors in agriculture.

Even a superficial survey of the varied interests of the farm will be found sufficient to show the great predominance of vital activities in the processes of production with which the farmer is concerned. The field crops which he grows and the animals which consume them will at once be suggested as illustrations of the "life" of the farm, that must be managed in conformity with biological laws to obtain the best results; but these are not by any means the only living organisms that are of immediate practical interest.

We have seen that the micro-organisms of the soil have an indispensable role to perform in the elaboration of plant food; and even in the nutrition of animals there is evidence that microscopic forms of life pervade the system of even the highest in the scale of organization and take a part in preparing the food constituents for the processes of assimilation.

The parasites of both plants and animals, and the more obscure and less readily detected microbes that are known to be the cause of a long list of communicable diseases, the various kinds of fermentation, and the numerous species that bring about the processes of decay and putrefaction, together with the multitude of organisms concerned in the various operations of the household, are further illustrations of the manifold forms of life that are now attracting attention as important factors in rural economy.

In the progress of discovery in natural science there is a rapid and abundant accumulation of evidence to show that every interest and process of the farm is intimately connected with and dependent on the phenomena of life in its various phases and manifestations. From the significance of these factors in the economies of the farm it may be well to consider some of the distinguishing characteristics of living matter, and to trace the progress of discovery that has led to the present development of the science of biology.

**Characteristics of Living Matter.** — Life has been defined by Herbert Spencer as "the continuous adjustment of internal relations to external relations," which expresses the dominant idea of ceaseless change, but this is rather a definition of the physical manifestations of life, and the mystery as to what really constitutes life still remains.

While it is difficult to define life in satisfactory terms, the distinctive characteristics of living matter are obvious.

1. Of the 70 or more elements known to chemistry only 12 or 13 enter into the composition of living beings, and four of these elements, from the exceedingly complex and varied arrangement of their molecules, constitute the principal part of every living tissue.

Protoplasm, which is composed of complex compounds of carbon, hydrogen, oxygen, and nitrogen, with water, and a few mineral constituents in minute proportions, is only formed by living matter, in which it is so constantly present that it has been called the physical basis of life.

2. Metabolism, or a change in its constituent molecules, is constantly taking place in living matter, and this consists in the continuous disintegration of its protoplasmic substance and a corresponding compensating process of reconstruction; or, in other words, parallel coincident processes of destructive and constructive metabolism.

The death and constant renewal of the molecules of living matter is then an essential condition of life.

3. These processes of metabolism, including the addition of new materials in growth, are interstitial, that is to say, they take place in the molecules throughout the organism so that there is a continuous general renewal of substance.

4. Besides these molecular changes, living organisms pass through a definite cycle of transformations, from the germ to infancy, youth, maturity, old age, and the final death of the individual, and there is no exemption from this series of changes. Constructive metabolism predominates until maturity is reached and an equilibrium established, and then destructive metabolism is in the ascendency through the decline of old age until death.

5. Living matter has its origin in pre-existing living matter. Life only begets life, and provision is made for continuing the species by the separation of reproductive granules of protoplasm previous to the death of the individual. It will be seen that in living matter there must be a continuous exercise of the processes of nutrition, including digestion, respiration, assimilation, excretion, and reproduction.

Protoplasm must be considered as an essential constituent of living matter, and, it is not only undergoing incessant change, through the processes of constructive and destructive metabolism, but, from it, or through its agency, all other tissues or organic substances are formed. In the simplest organisms it performs all of the vital or nutritive functions, while in the more highly organized species its contained granules are differentiated to form special organs for the performance of each particular function. The materials or substances formed by living matter are therefore often spoken of as organic matter, or organic substance.

**Inorganic Matter.** — Inorganic or non-living matter, on the other hand, has a simple chemical composition, and it is not limited to a few elements. Any increase is by external accretion, and not by a true interstitial growth. It is not in a state of incessant molecular activity from the destruction and replacing of its constituent particles with new materials, and it is subject to change only from the action of chemical agencies, as by oxidation, etc.

The chemical changes in inorganic matter are clearly defined and readily traced, and may be expressed in definite formulæ, while, on the other hand, the transformations of matter and energy that take place in the nutrition and other activities of living beings, cannot be formulated or defined in specific terms, from their very complexity, and from the further fact that the laws of chemical affinity appear to be modified, and to some extent superseded, by vital activities, in accordance with the varying demands that arise in the metabolism of the tissues.

The molecules of carbon, hydrogen, oxygen, and nitrogen, that form the complex substance of protoplasm, are susceptible of arrangement in an almost infinite variety of ways, and we cannot doubt that the relative proportions of these elements are constantly changing in the nutritive processes of disintegration and reconstruction that are always in progress.

It is also evident that the food supply that is required to replace waste, or for increase in growth, must be reduced almost to its elements to make it available in the process of reconstruction. There is evidence to indicate that in the different tissues of the higher animals, and even in the same tissue at different times, the elements of the molecules of which they are composed are not affected alike in the process of destructive metabolism, and there must therefore be differences in the demand for particular elements in the reconstructive process. "It would almost seem as if the qualities of each particle of living protoplasm were of such an individual character that it had to be built up afresh from almost the very beginning; hence the immense construction which inquiry shows more and more clearly every day to be continually going on as well in the animal as in the vegetable body."

Biological activities must, however, be considered from another standpoint, from the fact that the metamorphoses of matter, to which our attention has thus far been exclusively directed, present but a superficial and one-sided view of the results of the metabolism of tissues in living beings. The changes taking place in the processes of nutrition and in the performance of other functions may be considered as modes of molecular motion, and the transformations of energy must be looked upon as of equal or even greater importance than the re-arrangement of the molecules of matter.

**Conservation of Energy.**—The law of the conservation of energy with which modern physics is chiefly concerned is directly applicable in all biological processes, and, when its significance as a factor in nutrition is not recognized in theories relating to the feeding of animals, it will be safe to discard them as of no practical value, from their failure to take into the account all details that may influence the results. An expenditure of energy is involved in the work of constructive metabolism, in replacing waste, or in building up new materials in growth, and the resulting complex organic compounds are, in effect, stores of energy, which is again liberated in the form of heat in the subsequent processes of destructive metabolism.

This heat may, in part, be again utilized in useful work in the reconstruction of tissues, and in the case of the higher animals the surplus represents the independent heat of the body. In the metamorphoses of matter which take place in the construction of tissues, and in their subsequent disintegration, there are then corresponding or parallel transformations of energy that cannot be ignored in a rational philosophy of nutrition. When attention is exclusively directed to the elements contained in the food, and in the tissues into which the food is to be converted, we are dealing with but one-half of the factors concerned in the vital problems of nutrition we are seeking to solve, and satisfactory inferences relating to the process cannot be made.

As somewhat closely connected with these applications of the laws of physics in biology, we should not fail to observe that the essential characteristics of living matter can only be manifest under favorable conditions of temperature, moisture, and food supply. Each special structure or form of life has requirements peculiar to itself, in relation to these conditions, that cannot be expressed in generalizations relating to the group or class to which they belong. The practical applications of this principle will be referred to in another place.

In the higher animals there are special mechanisms for maintaining a definite temperature independent of external changes; while in the lower forms of both plants and animals the external temperature determines the activity of the vital processes, when other conditions are favorable.

Some forms of life are killed by a low temperature, or by one that approaches the freezing point, while others endure a temperature very much below zero, by passing into a dormant condition in which the vital activities are apparently suspended until the temperature is again raised to a point that admits of a resumption of the processes of nutrition.

Animals that have an independent temperature, or the warm-blooded animals, as they are popularly called, can maintain their normal temperature when exposed to severe cold, and they may live for a considerable time without apparent injury under conditions of intense heat that would be immediately fatal to those of simpler organization. Many of the lower forms of life may be killed by a temperature but little above the range that is favorable for the exercise of their vital activities. In experiments made by Dr. Dallinger, organisms that were apparently thriving and performing their normal functions of reproduction at a given temperature were destroyed by an increase of heat of but a single degree.

As a general rule it may be said that a temperature which will coagulate protoplasm is fatal to the lower organisms. The microbes of fermentation and putrification are, almost

without exception, killed by a temperature of 125° to 130° F., in the presence of moisture, but when quite dry they may for a time survive a higher temperature. The spores, or germs, of these microbes may, however, be exposed for a short time to a much higher temperature than the mature organisms without being killed, but they finally succumb when lower degrees of heat are continued for some time or frequently repeated. Tyndall found that some of these germs were not killed at 212°, continued for several hours, but that even a lower temperature for one minute, if repeated at intervals of twelve hours, proved fatal.

The influence of temperature on the microbes of nitrification has already been noticed in discussing the metabolism of soils, and nearly all species are equally sensitive to slight changes in the temperature of their environment.

Similar variations in the vital activities of the lower forms of life may arise from changes in the amount of moisture and the supply of nutritive materials, which we need not describe in detail.

There is then abundant evidence to show that biological processes and activities cannot be measured or accounted for by purely chemical considerations, and that the supply of the chemical elements of food is not in itself all that is required to secure the efficient exercise of the processes of nutrition.

Biology has quite as intimate relations with physics as with chemistry, and contributions from both of these departments of science will be required in forming a consistent philosophy of the phenomena presented by living beings.

A knowledge of the properties which characterize all forms of life, and of the conditions under which they may be manifested, will be found of practical value to the intelligent farmer in many ways, and especially in enabling him to detect the fallacies of theories in regard to the feeding of animals and crops that are based on hasty generalizations from imperfect and limited observations in a single department of science.

**Microscopic Forms of Life.** — In summing up the results of recent investigations in science that have a direct bearing on the practice of agriculture, the large class of microscopic forms of life known as micro-organisms, or more specifically as microbes, or bacteria, should receive more than a passing notice. Attention has been called to some of those organisms in their relations to soil metabolism, and in a foot-note an outline of their classification is given.

There are several sub-divisions, or departments of biology, each dealing with distinct groups of living forms and following special lines of investigation. Botany and zoölogy are prominent and familiar departments of biology that are concerned with the higher forms of plant and animal life, and a parallel department called bacteriology has recently been recognized, which is exclusively devoted to the study of microbes, or bacteria.

An outline of the progress of discovery will most readily indicate the scope and practical applications of this new department of biology.

Bacteria were first discovered by Leuwenhoek, a Dutch naturalist, in 1675, and in 1680 he observed the granules or cells of yeast. These yeast cells were again noticed by Fabroni of Florence in 1787, and by Astier in 1813, who claimed that they were living organisms, and the real cause of fermentation.

In 1836, Cagniard de la Tour, with better means of investigation, re-discovered the yeast cells, which he described as living plants that multiplied by a process of budding, and caused fermentation in the exercise of their processes of nutrition.

The leading chemists did not, however, accept this explanation of the phenomena of fermentation, and it was claimed by Liebig that the soluble part of the yeast, and not the granules or cells, caused fermentation by a process of oxidation when exposed to the air.

Experiments were made by Schultze and Schwann in 1836–8, and by Helmholtz in 1843, that were in direct conflict with this chemical theory and a substantial confirmation of the views of Astier and Cagniard de la Tour.

Notwithstanding this accumulation of evidence that the living yeast cells were the cause of fermentation, Liebig published a modified form of his theory which was generally accepted by chemists as authoritative and conclusive. This was, however, but a revival of the theory advanced by Willis in 1659, and by Stahl in 1697; and although it was for many years unquestioned by writers on chemistry, it wholly ignored the real factors of fermentation.

The researches of Pasteur from 1857 to 1862 were conducted on an original plan that enabled him to trace the influence of each separate organism on the fermentable materials under investigation, and there seemed to be no escape from his conclusions that fermentation was a purely biological process. He showed that the different ferments were not only living organisms but that they could be cultivated as separate and distinct species, and that each in its processes of nutrition produced a fermentation peculiar to itself. From the results of his experiments it was evident that the cells of yeast were the true alcoholic ferment, and that the lactic, the acetic, and the butyric fermentations were each caused by distinct specific forms of microbes.

This marked the first stage in the development of the new science, but his conclusions were not accepted by chemists who were disposed to criticise any evidence that conflicted with Liebig's theory, which they continued to maintain.

Pasteur answered every objection and criticism of his opponents by new experiments in which every possible element of error was eliminated, and in the course of thirty years he published more than fifty memoirs relating to his experiments with micro-organisms, in all of which his remarkable skill and fertility of resource as an investigator were clearly manifest.

His opponents were compelled, step by step, to abandon the positions they had taken, and a change in the point of attack finally led to a review of the whole subject from a new standpoint. The publication of "*The Origin of Species*" in 1859 gave a new impetus to the study of micro-organisms, and it was soon followed by a revival of the old doctrine of spontaneous generation, as a corollary of Darwin's theory and a convenient method of accounting for the origin of life. It was assumed that the different kinds of ferments described by Pasteur and other observers were not distinct species descended from pre-existing ancestors, but that they were formed spontaneously in fermentable and putrescible materials under favorable conditions.

This theory of the origin of life had been repeatedly suggested by the old philosophers and had as often been shown to be untenable by experiments like those of Redi in 1668, of Leuwenhoek in 1680, of Spallanzani in 1780, of Schultze and Schwann in 1836–7, and of Schroeder and Dusch in 1854, but its later advocates claimed to have proved its truth by direct experimental evidence.

The fallacies of these later experiments were clearly demonstrated by Pasteur and Tyndall, who succeeded in proving by exact methods of investigation that spontaneous generation was a chimera, and that all forms of putrefaction and fermentation were caused by living organisms that had their origin in pre-existing germs in the floating matter of the air.

This marked the second stage in the development of the new science, and rapid progress was then made in researches relating to the cause of contagious diseases and the general role of micro-organisms in the economy of nature.

In 1863–4 Devaine proved that anthrax, one of the most fatal diseases of animals, was caused by rod-like microbes, which found favorable conditions for their reproduction and growth in the blood.

In 1866 the results of Pasteur's investigations of the diseases of wine and of the silk-worm disease were published. These proved to be of great practical value, as they led to improved methods of wine-making to avoid the action of putrefactive or false ferments; and the silk industry, which had been almost destroyed by a contagious disease of the silk worms, was revived and again made profitable. These results were obtained by a study of the life history of the invading microbes and the discovery of remedies to prevent their ravages.

In the course of the next ten years many papers were published relating to the microbes of putrefaction, fermentation, and especially those of contagious diseases, among which those of Pasteur, Tyndall, Lister, Klein, and Klebs are particularly worthy of mention, and then followed, at intervals, a series of remarkable discoveries of great practical interest.

In 1876 Koch succeeded in tracing the life history of the anthrax bacillus, and its reproduction by spores, as well as by the ordinary process of fission, was established. In the same year Pasteur made an important contribution to our knowledge of the living organisms of fermentation in his *Studies of the Diseases of Beer*, which turned attention to the breeding and cultivation of pure yeast as an indispensable condition of successful beer-making, and this industry of breeding yeast has come to be of considerable commercial importance.

The following year (1877) Schloesing and Müntz made the discovery that nitrification was caused by microbes, and this has given a new direction to investigations relating to the metabolism of soils and the relations of microbes to the nutrition of plants, with a promise of valuable results.

In 1878 Pasteur described the specific microbe of chicken cholera, and in 1879 he published a method of ameliorating the activity of the anthrax bacillus, and demonstrated the advantages of protective inoculation with the modified virus. He has since that time developed a method of protective inoculation for hydrophobia, and special laboratories, or hospitals, for the preventative treatment of the disease have been established.

In 1880 Professor T. J. Burrill of Illinois made the discovery that pear blight was caused by a microbe, and he proved by direct inoculation that the disease was contagious.

Tuberculosis, one of the most insidious and fatal of the diseases of animals, is now placed in the list of communicable diseases through the researches of Koch in 1882, who discovered the bacillus that is its exciting cause. It had for some time been believed that it might be communicated from one animal to another, but the fact of such transmission is now placed beyond doubt, and it is also well known that it may be communicated to man through the medium of the meat or the milk of diseased animals.

A knowledge of the real cause of contagion in communicable diseases is of the first importance in deciding upon the means of preventing or controlling them, and the progress of discovery seems to indicate that diseases like anthrax and tuberculosis, that are so widely prevalent, may, by proper sanitary regulations, be entirely suppressed.

From investigations made by the Bureau of Animal Industry at Washington, it now appears that there are two well-defined diseases of swine, caused by specific microbes, which have heretofore been confounded under the common name of hog cholera. The one for which the term hog cholera is retained is caused by a bacterium, and the principal lesions are found in the alimentary canal or its vicinity. The other, called swine plague, is caused by a micrococcus, and the lungs are the organs more particularly affected.

Pleuro-pneumonia, which is so prevalent among cattle in certain localities in the Eastern States, and may become a serious plague in the West unless energetic measures are taken to control it, is another of the contagious diseases that has been proved to be caused by microbes. But we need not attempt a complete enumeration of the diseases in which specific contagia have been discovered in order to show the importance of this branch of biological

science. Micro-organisms have been proved to be the cause of such a number of diseases that it may be fairly assumed that they are the exciting cause of all communicable diseases, and the obvious remedy in all cases must be to prevent the development and diffusion of the organisms that give rise to them.

**Size and Reproduction of Microbes.** — Those who are not practically familiar with microscopic forms of life will be aided in forming a rational conception of their significance in the economies of nature by some further illustrations of their extreme minuteness and powers of multiplication and reproduction.

Many of the forms to which reference has been made are so minute that from 20,000 to 40,000, or even more, could be laid side by side in the space of one inch, and for a satisfactory study of them a magnification of at least from 500 to 1,000 diameters will be required. The effects of such amplification will be best appreciated by applying it to some familiar object. A man magnified 1,000 times would appear as high as Mt. Washington, or six times the height of the Eiffel tower. When we consider the fact that such a magnifying power would only make some of these organisms barely visible, their insignificance, so far as size is concerned, may be admitted, notwithstanding our inability to form any definite conception of such exceedingly minute objects.

It is only when we come to take into account their inconceivable powers of multiplication that their efficiency in the work they are capable of doing can be correctly estimated. Microbes have two modes of reproduction that are readily distinguished. In the one spores, or germs, are formed, which, when developed under proper conditions, form new individuals; while in the other, which is more commonly observed, each individual, by a process of fission, is divided into two equal parts, and these again divide in the same way to form four, and so on indefinitely, each subdivision, by a correlative process of growth, having the form and size of the original individual from which they have sprung.

This process of division has been observed to take place, under favorable conditions, every hour, and at this rate the offspring of a single individual, in twenty-four hours, would number more than sixteen and three-fourths millions, and if this rate of increase is carried on for another twenty-four hours the numbers could not be expressed in figures that could be comprehended.

By extending this method of computation Cohn makes the estimate that the produce of a single *Bacterium termo*, a common putrefactive microbe, under favorable conditions, would fill the oceans of the world to the depth of one mile in five days.

But little experience in the breeding and cultivation of microbes, under definite conditions, will be required to clearly demonstrate the reasonableness of this conclusion. That such astounding results are not realized in the economy of nature may be easily explained by the prescribed limits of their food supply, the lack of suitable media in which their activities may be exercised, and the antagonism of competitors in the struggle for existence.

From their rate of increase and voracious habits of feeding, their food supply is soon exhausted, and they are soon superseded by other forms that are better adapted to the changed conditions resulting from their own activities, and a number of species are thus found in succession in the ordinary processes of putrefaction. In pure cultures of microbes uniform conditions are provided, and competing forms are carefully excluded, and then frequent renewals of the colony by the transfer of a few individuals to a fresh supply of the nutritive media may be required to maintain the full exercise of their activities for any length of time

**Microbes in Household Economy.** — The success or failure of many of the ordinary processes of the household are directly determined by the agency of these microscopic forms of life. In bread-making, for example, the results will depend upon securing condi-

tions that are especially favorable for the micro-organisms, that are essential to the process, while at the same time other forms are kept in check that would have an adverse influence.

When one of the common tin-foil packages of commercial yeast is examined under a good microscope, the yeast cells which are the true ferment, and grains of starch, form the principal mass, but there are also other micro-organisms, more or less numerous, that must be looked upon as impurities or false ferments. Sometimes the yeast is nearly pure, but usually it is not difficult to find two or three species of microbes, which may be separated and cultivated by themselves by furnishing them suitable conditions of temperature and food supply for their rapid development.

When the prescribed conditions in bread-making are best adapted to the growth and multiplication of the yeast cells, they will be the dominant factors of the process, and the desired results will be obtained. But if, on the other hand, the conditions are more favorable for the invading microbes which constitute the impurities of the yeast package, they may increase so rapidly as to interfere with the normal activities of the yeast cells, and the results are usually attributed to "bad luck."

A variation of but a few degrees in temperature may be sufficient to check the activity of one species and give another form an advantage in its processes of nutrition, and the fittest only will survive. In what is called "salt rising" the active agents of fermentation are bacteria, and not yeast cells, and here, too, any slight variation from the conditions that favor the activity of the useful sorts may lead to the multiplication of other species that are not beneficial.

The canned articles of food which are found in the market in such variety, and the canned fruit which every housewife prepares, are preserved by the application of heat, which kills the microbes of fermentation, and the subsequent sealing of the cans prevents the access of germs from the atmosphere. The success of the process depends upon the killing of the microbes that are always present, and then preventing the access of a new supply from the air.

As an inference from Liebig's unfounded theory, which has already been noticed, it was formerly supposed that canned articles of food were heated to expel the air, and that they were then preserved by protecting them from the action of the oxygen of the air, but this has been proved to be an error. Organic substances of all kinds may be preserved when freely exposed to the air if the microbes in contact with them are first destroyed, and they are then protected from an invasion of fresh forms, or their germs, from the air.

A plug of sterilized cotton (*i. e.*, cotton heated until slightly scorched to kill its contained microbes) is an efficient protection from atmospheric germs, as the air that passes through it is thoroughly filtered.

When we come to realize the fact that all processes of fermentation and decay are brought about by the activity of microbes, and that they cannot take place when these organisms are excluded, it will be easy to explain many of the unexpected results that arise in various operations on the farm.

**Struggle for Existence.** — From the rapid geometrical rate of increase of living beings which may be observed on every side, it will be seen that the limits of subsistence would soon be reached if there were no checks to reproduction, and that a struggle must inevitably arise between competing species for the means of existence.

Darwin's "natural selection" and Herbert Spencer's "survival of the fittest" are expressions of the law of evolution, that the forms best adapted to the conditions of the evironment will survive, from the advantage they have in the struggle for existence, and that less favored forms will be crowded out and perish.

In almost every operation of the farm may be seen striking illustrations of this law, and the farmer is consciously and directly, or inadvertently and indirectly, engaged in furnishing conditions that are favorable for the forms of life that may best contribute to his immediate interests, and in keeping in check those that are not beneficial.

The competition of weeds with farm crops will at once be suggested as an illustration of the struggle for existence, and it will be admitted, without hesitation, that the farmer must take an active part in promoting the welfare and survival of the fittest for his special purpose.

The characters that give value to our farm crops and animals have been developed by artificial treatment and selection, and a wide divergence from the original stocks from which they are descended has been secured. These characters are readily modified by changed conditions, and constant attention is required to retain the highly artificial peculiarities that give them their greatest value.

Our field crops, from their special nutritive requirements, are therefore placed at a disadvantage in the struggle for existence with more stable and hardier competing forms, like weeds, that are not as particular in the selection of their food materials. Our improved breeds of animals, for the same reasons, cannot thrive without better supplies of food than would be required by their unimproved and more hardy ancestors.

The diverse forms of life that the farmer has to deal with have relations of interdependence that are quite remarkable, and the many cases in which the antagonisms that arise between certain species in the struggle for existence have a decided influence on the prosperity of other species seem to indicate that a knowledge of the habits and life history of every species must be of great practical value.

The direct and obvious results observed are frequently less significant factors in the economy of nature than the remote and less readily detected consequence of a series of apparently disconnected events, which are thought to be of but little importance when separately considered.

That cats may have a marked influence on the growing of clover seed, as pointed out by Darwin, cannot be doubted, notwithstanding the apparent absurdity of the proposition when simply stated, without reference to the evidence on which it is based. He "found that the visits of bees are necessary for the fertilization of some kinds of clover; for instance, 20 heads of Dutch clover (*Trifolium repens*), yielded 2290 seeds, but 20 other heads protected from bees produced not one; again, 100 heads of red clover (*Trifolium pratense*) produced 2,700 seeds, but the same number of protected heads produced not a single seed. Humble-bees alone visit red clover, as other bees cannot reach the nectar. Hence, I have very little doubt that if the whole genus of humble-bees became extinct or very rare in England the heartsease and red clover would become very rare or wholly disappear."

These experiments have been repeated by other observers, and it is now generally admitted that the fertilization of clover and the formation of seed depends upon the agency of humble-bees in their visits to the blossoms. Mr. Newman, who made a special study of humble-bees, found that their numbers were seriously diminished by the ravages of field mice that destroyed their nests and comb. Cats, the natural enemies of field mice, abound in the vicinity of villages, and here, as might be expected, the nests of humble-bees were found in greater numbers. In growing clover seed it is therefore evident that humble-bees should be protected from the attacks of their natural enemies.

The competition of plants in the struggle for existence may best be studied in the mixed grasses of permanent meadow, or pasture, as changes are constantly taking place in the relative proportions of the different species, from the influence of seasons, or the application of manures.

In the Rothamsted experiments with permanent meadow, a botanical analysis of the produce of each plot was made at intervals of five years, to determine the relative and absolute proportion of each species under different conditions of manure supply. Our limits will not permit an extended discussion of these valuable and interesting experiments, but a summary of the results on five of the twenty-two plots are given in Table 27, which may profitably be studied.

TABLE 30.

*Influence of Manures on the different species of Plants in Permanent Meadow.*

| Separation Years. | Plot 3. Unmanured continuously. | Plot 7. Mixed Mineral Manure alone, every year. | Plot 9. Mixed Mineral Manure, and 400 lbs. Ammonia-salts, every year. | Plot 11. Mixed Mineral Manure, and 800 lbs. Ammonia-salts, every year. | Plot 14. Mixed Mineral Manure, and 550 lbs. Nitrate of Soda, every year. | Means. |
|---|---|---|---|---|---|---|
| TOTAL NUMBER OF SPECIES FOUND. | | | | | | |
| 1862, . . . . | 50 | 44 | 28 | 25 | 28 | 35 |
| 1867, . . . . | 43 | 42 | 29 | 19 | 30 | 33 |
| 1872, . . . . | 49 | 41 | 30 | 16 | 30 | 33 |
| 1877, . . . . | 52 | 44 | 27 | 16 | 27 | 33 |
| Average of the 4 years, | 49 | 43 | 29 | 19 | 29 | 34 |
| GRAMINEOUS HERBAGE—Per cent. (by weight) in Total Produce. | | | | | | |
| 1862, . . . . | 68.65 | 63.21 | 88.43 | 91.72 | 88.83 | 80.17 |
| 1867, . . . . | 62.46 | 58.69 | 76.68 | 94.89 | 93.60 | 77.26 |
| 1872, . . . . | 67.92 | 47.85 | 92.08 | 99.05 | 92.77 | 79.93 |
| 1877, . . . . | 71.15 | 74.38 | 94.65 | 98.00 | 87.81 | 85.20 |
| Average of the 4 years, | 67.55 | 61.03 | 87.96 | 95.91 | 90.75 | 80.64 |
| LEGUMINOUS HERBAGE—Per cent. (by weight) in Total Produce. | | | | | | |
| 1862, . . . . | 8.59 | 25.42 | 0.13 | 0.01 | 0.13 | 6.85 |
| 1867, . . . . | 5.73 | 12.84 | 0.16 | 0.01 | 0.39 | 3.83 |
| 1872, . . . . | 9.17 | 40.26 | 0.02 | 0.01 | 1.36 | 10.17 |
| 1877, . . . . | 8.54 | 13.71 | 0.41 | 0.00 | 0.76 | 4.68 |
| Average of the 4 years, | 8.01 | 23.06 | 0.18 | 0.01 | 0.66 | 6.38 |
| MISCELLANEOUS HERBAGE—Per cent. (by weight) in Total Produce. | | | | | | |
| 1862, . . . . | 22.76 | 11.37 | 11.44 | 8.27 | 11.04 | 12.98 |
| 1867, . . . . | 31.81 | 28.47 | 23.16 | 5.10 | 6 01 | 18.91 |
| 1872, . . . . | 22.91 | 11.89 | 7.90 | 0.94 | 5.87 | 9.90 |
| 1877, . . . . | 20.31 | 11.91 | 4.94 | 2.00 | 11.43 | 10.12 |
| Average of the 4 years, | 24 44 | 15.91 | 11.86 | 4.08 | 8.59 | 12.98 |

TABLE 30. — CONTINUED.

*Influence of Manures on the different species of Plants in Permanent Meadow.*

| SEPARATION YEARS. | Plot 3. Unmanured continuously. | Plot 7. Mixed Mineral Manure alone, every year. | Plot 9. Mixed Mineral Manure, and 400 lbs. Ammonia-salts, every year. | Plot 11. Mixed Mineral Manure, and 800 lbs. Ammonia-salts, every year. | Plot 14. Mixed Mineral Manure, and 550 lbs. Nitrate of Soda, every year. | Means. |
|---|---|---|---|---|---|---|
| GRAMINEOUS HERBAGE — POUNDS PER ACRE. | | | | | | |
| 1862, . . . . . | 2095 | 2796 | 5661 | 6525 | 5080 | 4431 |
| 1867, . . . . . | 2081 | 2616 | 4127 | 5511 | 6728 | 4213 |
| 1872, . . . . . | 1116 | 2027 | 5210 | 7075 | 5765 | 4238 |
| 1877, . . . . . | 1682 | 3793 | 5730 | 7495 | 5495 | 4839 |
| Average of the 4 years, | 1743 | 2808 | 5182 | 6651 | 5767 | 4430 |
| LEGUMINOUS HERBAGE — POUNDS PER ACRE. | | | | | | |
| 1862, . . . . . | 262 | 1125 | 8 | 1 | 7 | 281 |
| 1867, . . . . . | 191 | 573 | 9 | 1 | 28 | 160 |
| 1872, . . . . . | 151 | 1705 | 1 | 1 | 85 | 390 |
| 1877, . . . . . | 202 | 699 | 25 | 0 | 48 | 195 |
| Average of the 4 years, | 202 | 1026 | 11 | 1 | 42 | 257 |
| MISCELLANEOUS HERBAGE — POUNDS PER ACRE. | | | | | | |
| 1862, . . . . . | 695 | 503 | 733 | 588 | 631 | 630 |
| 1867, . . . . . | 1060 | 1269 | 1246 | 296 | 432 | 860 |
| 1872, . . . . . | 377 | 504 | 447 | 67 | 365 | 352 |
| 1877, . . . . . | 480 | 608 | 299 | 153 | 715 | 451 |
| Average of the 4 years, | 653 | 721 | 681 | 276 | 536 | 573 |
| TOTAL MIXED HERBAGE — POUNDS PER ACRE. | | | | | | |
| 1862, . . . . . | 3052 | 4424 | 6402 | 7114 | 5718 | 5342 |
| 1867, . . . . . | 3332 | 4458 | 5382 | 5808 | 7188 | 5233 |
| 1872, . . . . . | 1644 | 4236 | 5658 | 7143 | 6215 | 4980 |
| 1877, . . . . . | 2364 | 5100 | 6054 | 7648 | 6258 | 5485 |
| Average of the 4 years, | 2598 | 4555 | 5874 | 6928 | 6345 | 5260 |
| Av. 20 years, 1856–75, | 2383 | 3958 | 5711 | 6726 | 6407 | 5037 |

A comparison of the figures in the same column for each separation year throughout the table will show that the influence of the seasons varies with the different groups of herbage and with the conditions of the manure supply.

"The total number of different kinds of plants that have been found on the plots is eighty nine, of which twenty are grasses, ten leguminous (including the clovers and vetches), and the remainder, occurring usually in smaller proportions and belonging to many natural

orders, are conveniently grouped as 'miscellaneous.' The numbers and relative proportions of these, as noted in the growing herbage, or recognized in the samples taken from it, differ very much in different seasons, and more especially according to the nature of the manure employed."

"The grasses, both in number of species and in relative and actual amount of produce, exceed the plants of all other orders. The lowest produce occurs on the continuously unmanured plots; the highest on those to which a highly nitrogenous manure, such as ammonia-salts, or nitrate of soda, is continuously applied in combination with earthy and alkaline salts — especially potash. But while the total gramineous produce is thus increased by the description of manure just mentioned, the number of species is reduced. On the unmanured plots, on the average, sixteen different sorts of grasses may be found, each contributing a fair proportion to the total herbage; thirteen only are found on the highly ammoniated plots, and of these only a very few contribute materially to the crop, the remainder being present in such small quantities as to make but little difference in the totals."

"It is instructive to compare the different tendencies of the two most generally prevalent grasses: *Festuca ovina* and *Agrostis vulgaris*. As to structural endowments they would seem to be not unfairly matched, but the *Festuca* is conspicuously worsted on the plots highly dressed with nitrogenous manures, while the *Agrostis* is befriended by them, and its vigor and tufted habit are increased. *Poa trivialis* and *Holcus lanatus* afford contrasts of a similar character, the *Poa* being largely increased by nitrate of soda, while the *Holcus* is similarly acted on by ammonia-salts. Of the same character are the differences observable between *Agrostis vulgaris*, which is influenced by ammonia-salts, and *Holcus lanatus*, *Avena pubescens*, and *Avena flavescens*, which are especially acted upon by nitrate of soda. Very marked contracts between species of the same genus also occur as between such structurally very closely related plants as *Poa trivialis* and *Poa pratensis*, and between the three species of *Avena*. On the contrary, *Bromus mollis* and *Poa trivialis* are so far similar that nitrate of soda is very favorable to them both. *Poa pratensis* and *Agrostis vulgaris* concur in their liking for ammonia with mineral salts; while they manifest opposite tendencies with regard to nitrate of soda; *Poa pratensis* not being favored by it, while the *Agrostis* is so conspicuously."

"The largest proportionate quantities of *leguminosæ* occur on a plot to which mixed mineral manure with potash is applied (Plot 7, Table 30). Seasonal characteristics, even when favorable to these plants, do not suffice to overcome the injurious effects of some manures, as during many years of varying character as to climate they have been practically banished from the ammonia plots (see Plots 9 and 11 of table). On the whole, their requirements are opposite to those of the grasses, the conditions favoring the latter not being anything like so propitious to the leguminous plants. Thus the effect of nitrogenous manures, as observed on the experimental plots, is to banish or reduce, more or less completely, the *leguminosæ*, or so to favor the growth of the grasses, or certain of them, that the *leguminosæ* are overpowered. On the other hand, mineral manures, which are not by themselves very beneficial to grasses (Plot 7) are very propitious to the growth of leguminous plants. Potash is especially favorable to these plants; their predominance and produce is always enhanced when that substance is used in due proportions as a manure, and always diminished when it is omitted."

By reference to Table 30, it will be seen that on Plot 11, giving the highest yield of total mixed herbage, the percentage weight of the crop was as follows. nearly ninety-six per cent. grasses, one per cent. leguminous, and four per cent. miscellaneous. On Plot 7, giving the highest relative and actual yield of leguminous herbage, the percentage was: Sixty-one per cent. grasses, twenty-three per cent. leguminous, and nearly sixteen per cent. miscellaneous.

On Plot 3, continuously unmanured, the crop was made up of sixty-seven and one-half per cent. grasses, eight per cent. leguminous, and over twenty-four per cent. miscellaneous.

A comparison of the yield of each class of herbage in pounds per acre, as given in the lower half of the table, will show the influence of season and the manure on the relative proportions in the total herbage quite as clearly as the statement in percentages, but the quantitative relations of the yields is not as readily appreciated.

If the direct influence of the manure on the different species is alone considered, a false interpretation of the results will probably be made. It is true that in some cases the manures applied seemed to have an unfavorable influence on certain species, but this was undoubtedly of less significance as a cause of their diminished relative and actual proportions in the total product than the indirect results brought about through the struggle for existence.

On the unmanured plot the metabolism of the soil was not rapid, plant food was slowly elaborated, and the plants all made a comparatively feeble growth. The largest number of species was found here, but from the imperfect development of the individual plants there appeared to be room for all, as none of them were sufficiently vigorous to prove aggressive competitors in the battle of life.

In contrast with these conditions, where a variety of manures were liberally applied, the metabolism of the soil was decidedly increased and plant food was freely elaborated. The species that were best fitted to profit by the better food supply from their habits of feeding, the adaptation of the food to their special requirements, or for other reasons, grew with a luxuriance and vigor than soon enabled them to monopolize, as it were, the resources of the soil, and to overcome and crowd out their less favored competitors. From the greater luxuriance and more perfect development of the individual plants of the favored species there was less room for others, and the number of species was diminished by the encroachments of the forms that were best fitted to take advantage of the improved conditions.

The effects of the competitive struggle of different species on the herbage of permanent meadow, as observed in the comparatively equable climate of England, will probably be intensified under the extreme climatic conditions that prevail in most of the United States.

So far as my knowledge extends, no exact systematic experiments have been made in America to determine the effects of competition on the development or growth of different species in the herbage of permanent grass laud. That marked changes do occur in the relative proportion of species in meadow and pasture is a matter of common observation, but to what extent our peculiar climatic conditions intensify the results of competition or its influence on particular species in the struggle for existence has not been definitely determined. From the complexity of the problems involved in such investigations and the time required for their successful solution, they are not likely to attract attention until the futility of the present popular demand for immediate results in agricultural experiments has been fully demonstrated.

**Mixed Grass Seeds.** — Those who recommend the mixture of a great variety of grasses in American agriculture overlook the fact that the struggle for existence and survival of the fittest may have a greater influence on the character of the herbage of a pasture or meadow than the variety of seeds originally sown. A species that might succeed when associated with certain others in one locality may entirely fail in the same company in another locality.

In the light of the Rothamsted experiments with the mixed herbage of permanent meadow, and the results of common observation, the fallacy of experiments with different grasses, in small plots by themselves, where they are kept free from the influence of competing species, must be obvious.

Varieties that grow vigorously when cultivated alone, under favorable conditions, may not be able to maintain themselves when placed in competition with other species that are better adapted to the peculiar conditions of the climate. Moreover, a grass may grow well on an experimental plot and still prove a failure on the adjoining farms, to say nothing of more remote localities, under ordinary conditions of management. Grasses that thrive in the mixed herbage of meadows in the comparatively mild and uniform climate of England may not, under similar conditions of soil and manuring, be able to resist the encroachments of competing species under the wide range of temperature and the intense summer heat of our own climate.

Kentucky blue grass (*Poa pratensis*) seems to be better adapted to our climate than some, at least, of the exotic grasses, and it therefore has an advantage when brought in direct competition with them. In a number of instances that have come under my observation, where a variety of mixed grass seeds had been sown, they were soon crowded out by the more vigorons and aggressive *Poa pratensis*, and there are many localities in which this is likely to occur.

On some natural low land meadows, where heavy crops of hay were grown, at least ninety-five per cent. of the herbage was fowl meadow grass (*Poa serotina*), and other sown grasses had almost entirely disappeared. In deciding upon the advantages of a mixture of grasses, the cost of seed may fairly be considered in connection with their fitness to survive the competition with other species under the conditions of climate and manuring in which they are placed.

From the experience of farmers in the Northern States, timothy (*Phleum pratense*) and red top (*Agrostis vulgaris*) have been generally recognized as the standard grasses to be sown with clover in rotations, and it is a question as to the extent they can be profitably superseded by other grasses.

The applications of the science of biology in agriculture are so numerous that our limits will not permit an exhaustive discussion of them. The best results with the higher forms of life (our farm crops and animals) can only be obtained when we are able to trace their true relations to each other and to the simpler organisms, on some of which their very existence seems to depend.

The laws of nature cannot be expressed in simple formulæ, and we are liable to err in summing up the economies of the organic world from the limited and superficial nature of our observations. There is abundant evidence of the most complex relations of the various forms of life, and a wide range of knowledge is required to properly interpret them.

In the breeding and care of the live stock of the farm; the management and application of manures; the arrangement of crop rotations; the treatment of permanent meadow and pastures; and in the diseases of plants and animals, the applications of established biological principles are so evident that a revision of past theories relating to these subjects is required in the light of this new department of science.

The farm may be looked upon as a microcosm of living beings with endowments of mutual interest or direct antagonism, and the interests of the farmer must prompt him to study their habits, modes of life, and interdependent relations, so that he may act intelligently in his efforts to foster and encourage useful forms and control or keep in check those that are injurious, and give such direction to the sum of their activities that all may be made to contribute to his welfare.

# IMPROVEMENT OF ANIMALS.

Pure-bred animals of all kinds have been so extensively introduced in nearly all of the States that farmers now have opportunities for improving their live stock, at a comparatively moderate cost, that should not be neglected. In mixed husbandry the profits that may be realized from the sum of operations must depend, to a great extent, on the quality of the animals with which the farm is stocked.

Inferior animals can only return a profit when high prices are obtained for farm products, and as prices fall the demand for improved animals, that will perform the required work with greater economy, becomes imperative. The lower the prices the more urgent the necessity for better animal machinery to convert vegetable into animal products without loss or waste. Only the best machinery will serve the purpose when the margin of profit is a narrow one.

From the number of breeds, each of which has its own peculiar qualities that adapt it to a definite purpose, a selection of animals may be made to answer the requirements of almost every locality and system of practice. In deciding upon the breed that is best adapted to the special conditions of the farm and the leading object in view, a number of details must be considered, and a knowledge of the particular qualities required and of the distinguishing characteristics of the different breeds will be needed in making a wise choice and avoiding mistakes.

Experiments to determine the relative value of different breeds under the same conditions are not only futile but absolutely misleading in their results, from the fact that the inherited qualities and habits of the distinct breeds fit them for entirely different purposes, and they are not, therefore, directly comparable. From the wide differences in their habits and tendencies the best and characteristic qualities of each breed will only appear under different conditions and systems of management. When direct experiments are made that settle definitely the relative merits of a hoe and spade, or of the roadster and the draft horse, we may expect to derive some benefit from similar experiments in which different breeds of cattle and sheep of diverse habits and requirements are compared from a common standpoint.

Breeders have been alarmed at the shrinkage in prices of pure-bred animals in common with other farm products, and the question is frequently raised as to the results that will probably follow when every farm is stocked with the pure breeds If proper selections are made for the special purpose in view in each case, this would indicate a marked improvement in the agriculture of the country, and its effects upon the breeder of choice animals for strictly breeding purposes would in the end be beneficial.

The skillful breeder who can show an appreciable advantage in the profitable qualities of his animals will have no difficulty in disposing of them at remunerative prices. Farmers will be compelled, by the logic of events, to make closer discriminations in regard to the intrinsic value of their animals, and even slight advantages will be appreciated that were formerly neglected.

The high prices of pure-bred animals of a few years ago were the result of a limited supply and increased demand for certain families that had been successful as prize-winners, and speculation took the place of legitimate breeding, and the true principles of improvement were neglected. Even the best breeders yielded to the temptation of high prices, and parted with the very animals that were needed for the improvement of their flocks and herds.

With lower prices and a greater diffusion of the pure breeds the motives for speculation will be diminished and there will be an increased demand for the best animals, as they are found to be essential to profitable production on average farms.

The principles of stock-breeding will be studied with greater care, and the net returns for food consumed will become the standard of excellence and the real test of merit. Premiums will not be offered for animals that make the best show in the prize-ring regardless of the cost involved in their production, and the performance of the animal machine in working up the vegetable products of the farm with the strictest economy will be the leading object of consideration.

## FEEDING OF ANIMALS.

At the present time there seems to be a tendency to exaggerate the importance of methods of feeding and to overlook, what is of greater consequence, the performance of the animal as a machine for the manufacture of meat, milk, wool, etc. The inherited habits of animals and the economy and efficiency with which they convert their food into animal products must be looked upon as the essential factor of profitable production, and the form in which the food may best be supplied will undoubtedly vary with the breed and the specific requirements of the individual at different times.

In this connection we must again call attention to the fact that the processes of nutrition are so exceedingly complex that they cannot be formulated in definite chemical terms, and that the activity and energy with which they are carried on must depend on a variety of conditions, none of which are by any means constant, and all are to be considered as essential to the normal performance of the function.

The requirements of animals of different breeds, and even of the same animal at different times, vary so widely that tables of the assumed actual, and relative, nutritive value of foods, based on their chemical composition, cannot have any practical interest.

**Nutritive Ratios.** — Attention has been called to Liebig's theory of fermentation, and its influence in retarding the progress of discovery; and we now have to notice his obsolete and equally unfounded theory of nutrition, on which the modern theory of nutritive ratios is founded. Liebig made a division of foods into two groups — the nitrogenous, or nutritive (including the proteids, of which albumen or the white of eggs may be taken as the type), and the non-nitrogenous, or "respiratory" (the carbohydrates, including starch, sugar, fats, etc.).

The nitrogenous group were assumed to be exclusively used in nutrition, in the building up of muscle and other nitrogenous tissues, and they were also the source of muscular energy; while the carbohydrates, or non-nitrogenous group, were used to produce animal heat by being burned in the system like fuel, and any surplus of these not needed for heating purposes was stored up in the form of fat. This was apparently so simple and plausible that it was accepted as the correct explanation of the relations of foods to nutrition, by chemists generally, and quite a number of physiologists, for many years.

The science of physiology has, however, made rapid progress since the time of Liebig, and it is now known that his division of foods has no physiological significance so far as the assumed separate function of these groups of nutrients is concerned. Proteids are not the only substances concerned in the nutrition of the tissues, and animal heat is not caused by a combustive oxidation of the carbohydrates: in fact, the latest investigations seem to indicate that in the metabolism of muscle there is a greater demand for the carbohydrates as sources of muscular energy than for the proteids. After a careful discussion of our present knowledge relating to the subject, Dr. Foster, who has a well-deserved reputation as a physiologist, tells us it is evident "that during muscular contraction an explosive decomposition takes place, the non-nitrogenous products of which alone escape from the muscle and from the body, any nitrogenous products which result being retained within the muscle. We

must, therefore, reject the second as well as the first division of Liebig's view : not only is the muscle not fed exclusively on proteid material, but also its energy does not arise from an exclusively proteid metabolism."

Heat, as we have pointed out in the review of the characteristics of living matter, is liberated in the process of destructive metabolism, which is constantly going on in living organisms — in plants as well as in animals — and it may likewise be noticed that in the higher animals the muscles, which are the typical nitrogenous tissues, are the principal source of heat, from the great activity of this process, and that carbonic acid is one of the products of destructive metabolism. Moreover, there is no evidence that anything like a combustive oxidation of carbon takes place in the living tissues ; oxygen is as much needed as food in the constructive metabolism of the processes of nutrition, as carbon, hydrogen, and nitrogen, all of which are required to form the complex compounds of which protoplasm is composed.

The so-called nitrogenous tissues of the body contain a smaller proportion of nitrogen than they do of carbon and oxygen. Muscle, for example, is estimated to contain 16.18 per cent. of proteids, and the percentage of the four elements in the proteids is from 51.5 to 54.5 of carbon ; 6.9 to 7.3 of hydrogen ; 15.2 to 17.0 of nitrogen, and 20.9 to 23.5 of oxygen. Or, stated in another form, muscle is made up of about 75 per cent. water, 13.0 per cent. of carbon, 1.89 per cent. of hydrogen, 5.39 per cent. of oxygen, and 2.59 per cent. of nitrogen, the proportion varying, of course, in different animals and different muscles.

The composition of the body as a whole has been estimated to consist of 72 per cent. oxygen, 9.1 per cent. hydrogen, 2.5 per cent. nitrogen, and 13.5 per cent. of carbon. We cannot therefore safely assume that nitrogen is the dominant factor in nutrition, and base our theories on an exclusively nitrogenous metabolism.

Again, it is not true, as assumed by the modern advocates of nutritive ratios, that the proteids and carbohydrates of the food are built up in the system, as such, like the bricks and mortar in a building. It would be quite as reasonable to assume that the mulching of trees with sawdust would directly aid in the formation of wood. In vegetable nutrition it is known that the constituents of plant food must be reduced almost to their elements before they can be appropriated by plants in the processes of nutrition, and no intelligent person would think of claiming that they must be fed with proteids to make proteids, or with starch to make starch, or with wood to produce wood.

In discussing the subject of manures we have noticed the important fact that the composition of plants gave no indication of the kind of manure required by them. Clover and the leguminous plants generally contain more nitrogen in their composition, but they are not benefited by nitrogenous manures, while the cereals, containing very much less nitrogen, are characteristically benefited by nitrogen in the manure, and they also seem to exercise a choice in the form in which it is supplied.

All of the late investigations in physiology show conclusively that with animals likewise the composition of particular tissues is not an indication of the particular form of food required in their nutrition and reconstruction, and that apparently similar tissues, so far as composition is concerned, have varied requirements in different animals, and even in the same animal, arising from differences in their vital activities.

After discussing in detail the products of destructive and constructive metabolism, and pointing out the evidence that the complex substance of living protoplasm is not constant in composition under different conditions, Dr. Foster says "the protoplasm of the swiftly contracting striped muscular fibre must differ from that of the torpid, smooth unstriated fibre ; the protoplasm of human muscle must differ from that of a sheep or a frog ; the protoplasm of one muscle must differ from that of another muscle in the same kind of animal ; and the protoplasm of Smith's biceps must differ from that of Jones's.

"We may for a moment turn aside to point out that this innate difference of protoplasm serves to explain the conclusions to which modern investigations into the physiology of nutrition seem to be leading. So long as we speak of muscle or flesh as one thing, the step from the flesh of mutton which we eat to the flesh of our body, which the mutton when eaten becomes, or may become, does not seem very far; and the older physiologists very naturally assumed that the flesh of the meal was directly, without great effort and without great change, so far as mere chemical composition is concerned, transformed into the muscle of the eater. The researches, however, of modern times, go to show that the substances taken as food undergo many changes and suffer profound disruption before they actually become part and parcel of the living body, and conversely that the constructive powers of the animal body were grossly underrated by earlier investigators. If one were to put forward the thesis that the proteid of a meal becomes reduced almost to its elements before it undergoes synthesis into the superficially similar proteid of muscle, the energy set free in the destruction being utilized in the subsequent work of construction, he might appeal with confidence to modern results as supporting him rather than opposing him in his views."

Proteids are spoken of in nutritive ratios as if they were substances of well-defined composition that can be prescribed in definite proportions, but we know little of their real constitution. According to Strecker, "accurate formulae have not yet been obtained for any of these bodies (proteids), but from the results obtained it is certain that their molecules are large and of very complex structure." Another writer on organic chemistry is satisfied that "the different radicals which they contain differ not only in arrangements but in their relative proportions, and in some cases even in their nature."

In the analyses of feeds chemists do not even attempt to determine the proteids as proteids. The amount of contained nitrogen is multiplied by 6.25, and the product is assumed to represent the proteids, and this is the conventional meaning of the term in the published tables of the chemical composition of foods. Without even knowing the constitution of any of the proteids, we still have evidence that they differ in a number of essential properties, as may be seen in characteristic reactions under different conditions of the various albumens, peptones, globulins, fibrins, caseins, etc., etc., known in organic chemistry, and we cannot with reason assume that any one of them is approximately equivalent to living protoplasm, which in itself varies widely in many of its properties.

"It is worthy of notice, however, that even simple forms of protoplasm, like that constituting the body of the white corpuscle, forms of protoplasm which may fairly be considered native protoplasm, when they can be obtained in sufficient quantity for chemical analysis, are found to contain some representatives of carbohydrates and fats, as well as proteids. We might perhaps even go as far as to say that in all forms of living protoplasm the proteid basis is found upon analysis to have some carbohydrates and some fat associated with it. Further not only does the normal food, which is eventually built up into protoplasm, consist of all three classes, but, as we have seen in the sections on nutrition, protoplasm gives rise by metabolism to members of the same three classes; and as far as we know at present carbohydrates and fats when formed in the body out of proteid food, are so formed by the agency of living protoplasm by some living tissue. Hence, there is at least some reason for thinking it probable that the molecule of protoplasm is more complex than a molecule of proteid matter; that it contains in itself residues, so to speak, not only of proteid matter, but also of carbohydrates and fatty material."

Fats are usually classed with the carbohydrates, in forming nutritive ratios, but we do not know that they serve the same purpose as starch and sugar in the animal economy, and there are some facts which indicate that they differ in their behavior from the last-named articles.

**Ash Constituents.** — But there are other important factors in the economies of nutrition that are entirely ignored in the theory of nutritive ratios. It will be readily admitted that the ash constituents of foods are essential elements in the formation of bone and other tissues in young and growing animals, but the further fact that they have an important influence on the general processes of metabolism in the system is not as obvious. Dr. Foster says, "We know that the various saline substances are essential to health, that when they are not present in proper proportions, nutrition is affected. Dogs fed on food freed as much as possible from all saline matters, but otherwise abundant with a proper proportion of the food stuffs, soon exhibit symptoms showing that the metabolism of their tissues, especially of their central nervous system, is going wrong; they suffer from weakness soon amounting to paralysis, and are often carried off by convulsions, and more or less similar derangements of nutrition follow the absence or a deficiency of individual salts." In experiments with young pigs fed exclusively on corn meal, similar symptoms arise from a deficiency of salts in their food.

A comparison of two common articles of food will illustrate the futility of estimating feeding values from the proteids and carbohydrates alone, and omitting the ash constituents. Clover hay contains, according to published tables of analyses, from 1.42 to 3.33 per cent. of nitrogen, and from 6 to 7 per cent. of ash constituents, while corn meal contains from 1.14 to 1.65 per cent. of nitrogen and only 1.4 per cent. of ash in which there is but a very small proportion of lime. Some specimens of clover hay must then contain less nitrogen than some specimens of corn meal, but the average of 2 per cent. of nitrogen in clover and 1.47 per cent. in corn meal would be the sole guide in adjusting the proper balance in nutritive ratios. From what is known in regard to the marked influence of the salts, or ash constituents of foods on the processes of nutrition, as shown in the results of experiments above cited, is it reasonable to assume that the physiological values of these foods, as nutrients, can be measured by the relative proportions of proteids and carbohydrates which they contain when the ash constituents differ so widely.

In the feeding of pigs with corn meal exclusively, the effects of the deficiency of ash constituents in their food have been attributed to a lack of proteids by those who are looking on the proteids and carbohydrates as the only elements of feeding value.

The disturbance of the nervous centers from a deficiency of salts in the food, to which reference has been made, may interfere directly with the processes of nutrition in a variety of ways that should not be overlooked.

It is known that the nervous system has a decided influence on the digestion and assimilation of food, and this explains the great differences observed in the returns from food of the same chemical composition when they differ in palatableness. The food that is relished by animals is found to be nutritious, while they do not thrive on that which is not palatable, although containing the same relative proportions of what are called nutrients. The flavor from the salts of food cannot therefore be neglected as a factor in nutrition.

When we consider that the animal body contains as a whole but about 2.50 per cent. of nitrogen, and that what are called nitrogenous tissues, as muscle, for example, contain but a slightly higher percentage, it must be seen that the demands for this element in the processes of nutrition must be comparatively limited, and this view is supported by the results of feeding experiments.

In the Rothamsted experiments it was found that but a small proportion of the nitrogen of the food was stored up in the increase. In the "analyzed fat pig" fed for ten weeks on a mixed food having a ratio of nitrogenous to non-nitrogenous substance of 1 : 3.6, the nitrogen stored up in the increase was only 7.8 per cent. of that contained in the food, and the average amount stored up as increase by pigs, with a variety of food, in other cases, was

but 7.34 per cent. With sheep, less than 5 per cent. of the nitrogen of the food was retained in the increase.

In the metabolism of muscle it has likewise been proved, by direct experiment, that the proteid elements of the tissue are not wasted to the same extent as the carbohydrates, and the latter are more largely demanded in the work of reconstruction.

But our limits will not permit a full discussion of the fallacies involved in the theory of nutritive ratios. It is sufficient for our purpose to show that the processes of nutrition are so complex and so directly dependent on a great variety of conditions that we cannot consistently attempt to define the exact proportions in which only two of the factors concerned must be combined to produce the best results, while other essential elements are neglected.

Those who claim that what may be considered the normal diet in any particular case can be expressed in definite terms "affect a vain and delusive accuracy," which illustrates a common error, pointed out by Bacon, of assuming a greater simplicity of nature's operations than really exists.

As to the experimental evidence relating to nutritive ratios, "we may urge that the number of experiments have been few, and conducted on a few individuals only, at most. and that a larger number of experiments, with a variety of combinations of different amounts of the several food-stuffs might lead to a different result, especially if particular kinds of proteids, fats, or carbohydrates were used, and especial attention were paid to the salts."

The digestibility of foods must vary widely from the different conditions under which they are consumed and the difference in the digestive powers of different animals, or even with the same animal, at different times, and, as Sir John Lawes remarks on the results of artificial digestion, "the chemist's mode of separating digestible from indigestible substances is totally different from the process employed by the animal."

But in addition to the many difficulties in the way of formulating nutritive ratios, arising from the complex requirements of the animals and their varying powers of digestion, there is a further obstacle in the lack of uniformity in the composition of foods of apparently the same kind. An examination of the published tables of the composition of foods, in which the range of variation in the results are given, will show that an assumed average will probably differ materially from any particular sample. This is illustrated in Table 31, in which is given the range of variation in the dry substance and the proteids of a few common articles of food, without noticing other constituents that are quite as variable.

TABLE 31.

*Variation in the percentage of dry substance and "proteids" contained in common articles of food.*

| | Dry Substance. | | | Proteids. | | |
|---|---|---|---|---|---|---|
| | Lowest. | Highest. | Average. | Lowest. | Highest. | Average. |
| Maize fodder, ensilaged, . . . . | 13.0 | 28.4 | 19.48 | 0.7 | 2.8 | 1.49 |
| Maize fodder, field cured, . . | 63.5 | 83.8 | 77.17 | 3.8 | 8.3 | 5.38 |
| Clover hay, . . . . . . . . | 78.2 | 93.9 | 88.63 | 8.9 | 20.8 | 12.55 |
| Timothy hay, . . . . . . . . | 84.5 | 92.9 | 89.76 | 4.2 | 9.6 | 6.06 |
| Oats, . . . . . . . . . . . | 86.5 | 91.1 | 89.06 | 8.0 | 14.4 | 11.38 |
| Maize, average of 310 analyses, | 79.3 | 94.0 | 89.49 | 7.0 | 15.3 | 10.55 |
| Maize meal, . . . . . . . . | 74.5 | 92.0 | 84.15 | 7.1 | 10.3 | 9.16 |
| Cotton seed meal, . . . . . | 81.5 | 94.2 | 91.68 | 23.3 | 50.8 | 42.39 |

Aside from our lack of knowledge as to the precise proportions of the so-called proteids and carbohydrates that are needed to make the best ration for animals for any particular

purpose, or under any prescribed conditions, the absurdity of the published formulæ of foods that are given with so much particularity must be evident from the uncertainty as to the exact composition of the specific articles composing the ration.

It is undoubtedly true that a variety of foods have a decided advantage over any single article, from the fact that they are eaten with a greater relish; and, moreover, we may also suppose that they promote the activity of the digestive organs from the varied demands that are made on them.

The manurial value of foods will, however, be found of greater practical importance than their assumed nutritive value, and this should be especially considered in the economy of feeding.

With these facts in mind the intelligent observing farmer, who studies the habits and tastes of his animals, will have no difficulty in adapting his feed to the requirements of his stock, and the exercise of good judgment in assigning the rations in each particular case will be a better guide in feeding than any specific prescriptions based on theoretical considerations.

**Fat and Lean Pork.** — Liebig's fallacious theory of nutrition, based upon the assumed difference in the physiological significance of his groups of proteids and carbohydrates, has led to other errors in regard to the principles of feeding, which should receive a passing notice.

As the carbohydrates and fats were supposed to be used exclusively for the purposes of combustion to produce animal heat, it has been claimed that fat pork is an undesirable and unnatural article of food, especially in hot weather, and many changes have been rung on the fancied evils of pork eating, from purely theoretical considerations.

As a corollary of this same theory it was seriously announced that lean meat could be produced at will by feeding highly nitrogenous articles of food, and the imaginary ills arising from the use of fat pork were thus to be remedied.

The fallacy of both of these assumptions must be evident from the known facts of physiology, to which attention has been called in discussing the subject of nutritive ratios; animal heat is not produced by the combustion of fats, and but a limited amount of nitrogen is appropriated by the system when abundantly supplied in the food.

The relative proportions of fat and lean in animals seems to depend more upon their inherited characters and habits of nutrition than on the amount of nitrogen contained in the food consumed. With the same food one animal will fatten rapidly and another will only keep in store condition; in one there will be an accumulation of internal fat, and in another the fat will be more generally distributed, forming what is called marbled flesh. In the meat-producing breeds early maturity, or the ability to fatten at an early age, has been looked upon as a desirable character that has been carefully cultivated and encouraged.

It is well known that the growth and perfect development of young animals is promoted by a variety in their food supply, which must include a liberal proportion of the ash constituents, and when rapid growth is taking place there is an increased metabolism of the system, the tissues contain a larger percentage of water, and there is an increased consumption of food in proportion to live weight. The whole process of growth is marked by an intense activity of the nutritive organs which are working to their full capacity.

When highly nitrogenous foods form a large proportion of the ration when full feeding is practiced, the system is severely taxed to throw off in the excretions the surplus of nitrogenous materials that cannot be assimilated, and this may be carried to such an extent as to bring about a derangement of the organs of nutrition that is more or less serious.

A number of instances have come under my observation, in which the attempt to make lean pork, by feeding pigs liberally with bran and other nitrogenous foods, has resulted in the

death of the pigs from their inability to digest and dispose of the surplus nitrogenous materials furnished in their food.

When highly nitrogenous articles are freely used in feeding pigs, the quality of the pork produced is decidedly inferior to that obtained with the ordinary grains like corn and barley. The lean meat is tough and fibrous, and the fat is soft and flabby, and there appears to be a greater shrinkage, on the whole, in the process of cooking.

As to the unfounded prejudice against fat pork, we can only say that fat is one of the most valuable of the nutrients in ordinary diet, and in connection with the starch of the potato and the bread grains it must be looked upon as a standard article of food that cannot well be dispensed with. Butter, cream, lard, and fat meat are naturally considered as necessaries of life in our modern civilization, and the experience of farmers and working men generally furnishes a sufficient refutation of the claim of theorists that fat pork is not to be commended as a staple article of food.

It has even been said that "the object of the farmer in rearing stock for the butcher is mainly to convert cheap vegetable carbohydrates into dear animal fat," and experience shows that among the under-fed working people whose principal food is bread, the addition of fat in the form of bacon is one of the first of the inexpensive means of improving their diet.

The following table, giving the results of experiments with pigs consuming different foods, at Rothamsted, will be sufficient to show that the nitrogen stored up in the increase bears no direct relation to the amount of nitrogen in the food consumed.

TABLE 32.

*Nitrogenous substance consumed by pigs and stored up as increase for each 100 pounds of increase of live weight with different foods.*

| | Description of Foods. | | | |
|---|---|---|---|---|
| | Pen 2. Bran and Corn Meal with Beans and Lentil Meal. | Pen 3. Beans and Lentil Meal. | Pen 4. Indian Corn Meal. | Pen 5. Barley Meal. |
| Non-nitrogenous to one of nitrogenous substance in food, | 3.3 | 2.0 | 6.6 | 6.0 |
| Nitrogenous substance, In food, | 107.0 | 138.0 | 57.0 | 64.0 |
| Nitrogenous substance, Stored up in increase, | 6.1 | 6.7 | 5.3 | 6.5 |

The highly nitrogenous foods in pens 2 and 3 seem to have no advantage over the barley meal (containing very much less nitrogenous substance) in the amount of nitrogen stored up in the increase. The falling off in the nitrogen stored up in the increase in pen 4, where corn meal was fed, was undoubtedly owing to a deficiency in the ash constituents rather than to a lack of nitrogen in the food. During the first period of two weeks the pigs in pen 4 did not do well, and a mixture of coal ashes, common salt, and superphosphate of lime was furnished them, which was eaten with apparent relish, and the unfavorable symptoms disappeared, and good progress was then made. The barley meal had an advantage over the corn meal, not so much in the slight increase of nitrogenous substance as in the larger proportion of ash constituents.

## ENSILAGE.

The preservation of green fodder in pits or silos had been practiced in Germany many years previous to the publication of a detailed description of the process by Professor J. F. W. Johnston, in 1842. So far as we have any authentic records it appears that Adolf Reihlen, a sugar manufacturer near Stuttgart, Germany, was the first to preserve green corn fodder in silos, and he gave the results of his experience in a letter published in a German paper in 1862, with additional details in a second letter to the same paper, dated September 23, 1865.

In 1870 M. Vilmorin-Andrieux published a translation of these letters as part of a series of articles on the Ensilage of Maize, in the *Journal d'Agriculture Pratique*, and he called the attention of the farmers of France to the importance of this method of preserving green fodder. At this time, he tells us, the silos of M. Reihlen, 10 feet deep and 15 feet wide at the top, had an aggregate length of 3,200 feet, and his success in the ensilage of maize on this extended scale was every way satisfactory.

From the papers of M. Vilmorin-Andrieux and the experience of several French farmers who had tried the process, the present writer was induced to make an experiment in the ensilage of green corn fodder in 1875, in two silos 12 feet long and 6 feet wide, and with two similar silos filled with broom-corn seed, with the most satisfactory results so far as the preservation of the fodder was concerned. An account of these experiments, the first of the kind in this country, was published in *The Country Gentleman*, October 5, 1876, with translations of the experience of several French farmers who had practiced the system for several years. Mr. Francis Morris of Maryland made a silo in 1876, and the results of his experience were published in 1877.

A gentleman farmer of France, M. Auguste Goffart, published a book on the ensilage of maize in 1877, which was translated and reprinted in New York in the winter of 1878–9, and given a wide circulation to advertise the goods of the New York Plow Company, including an "Ensilage Cutter." This was considered the standard authority on the subject, and the claim has often been made that M. Goffart was the inventor or discoverer of the system of ensilage. This is, however, a mistake, as the ensilage of maize had been successfully practiced, not only by M. Reihlen in Germany, but also by a number of farmers in France, for a number of years before M. Goffart's first successful experiment. He was also preceded by others in making silos of masonry, which were claimed as an original and distinctive feature of his system.

The silos of masonry which were adopted and urged by the imitators of Goffart as essential to success in the ensilage of green fodder, retarded the general introduction of the practice from the expense involved in their construction, and it is now known that cheaper silos of wood are quite as efficient in preserving the silage.

Within the past seven or eight years decided improvements have been made in the ensilage of green fodder, and a number of details that added to the expense of the process and were thought to be essential are found to be entirely unnecessary.

The term ensilage is now used to indicate the process of preserving green fodder in silos, and the preserved fodder is called silage. A silo is in effect a tight box without a cover, in which green fodder is preserved, and it should be placed in convenient proximity to the stables to save labor in the handling of the silage, and its bottom should be on the same level with the feeding floor.*

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* In *Silos, Ensilage, and Silage*, Orange Judd Co., N. Y., will be found detailed directions for the construction of silos of wood, with illustrations of details that are so simple that a farmer may readily follow them without the assistance of a skilled workman.

**How to Build a Silo.** — The balloon frame is the cheapest and best form that can be used in building a silo, the scantling of which it is composed having squared ends, and the points of junction, without framing, are secured with round steel spikes which can now be obtained at about the same price as cut nails, and they are on many accounts much better.

There should be a stone foundation, laid in cement mortar, extending below frost and with the top above the surface of the ground to prevent any annoyance from surface water.

Sills two inches thick and of the same width as the studs of the walls, are then laid in cement mortar on the foundation. The end sills should be two inches lower than the sills at the sides, so that the latter may overlap the end sills at the corners, and be secured with four-inch spikes. To prevent spreading, the sills near the middle should be spiked to anchor blocks of short pieces of $2 \times 4$-inch scantling, set edgewise at intervals in the top of the foundation walls.

The walls of the silo may be 12, 14, or 16 feet high, according to the capacity required. The deeper silos of 20 to 30 feet, that are sometimes made, have no apparent advantage on the score of economy when everything is taken into consideration, as larger studs must be used, the sides are more likely to spring, and they are not as convenient in feeding out the silage.

The studs should all be cut of the same length and the ends squared before beginning the construction of the frame. As the studs are put in place, the foot of each is firmly toe-nailed to the sill, and the distance between them may be from 16 to 18 inches. Two-by-six inch studs 12 feet long, or $2 \times 8$-inch studs 16 feet long, will be found sufficient to give the required strength to the walls. A scantling two inches thick and the same width as the studs is spiked on top of them to form a plate, which should run completely around the building, with a lap at the corners made fast with spikes in the same manner as the sills are secured. With this arrangement of the frame the sheathing on both the inside and outside of the wall should completely cover the sill and the plate, to make the dead air space between the studs vermin proof.

The inside sheathing should be one-inch boards from 10 to 12 inches wide, laid double, in horizontal courses, with a sheet of tarred roofing-paper between, and the boards should be surface-dressed to secure uniformity in thickness, and thus make a tight, smooth wall. If care is taken to lay the boards so that the heart-surface is exposed there will be less danger of warping.

The outside covering may be patent siding, or any other material to make a suitable finish, but care must be taken to make a tight covering, as this forms one side of the dead air space, which should be perfectly closed.

In construction the studs on the end sills are to be set up in the first place, and carefully plumbed and stay-lathed to keep them in place. The studs at the extreme ends (of the end sills) should be inside and in contact with the inner edge of the side sills, to which they may be spiked. Then nail on the first layer of the inside sheathing so that the ends of the boards extend nearly to the outside edge of the sills on each side.

Then set up the studs on the side sills, with the end studs on each side in contact with the inside surface of the sheathing-boards already laid, which are nailed to the sides of these studs to bind the corners firmly together. The first layer of the inside sheathing is now nailed on the studs of the side walls, the ends of the boards abutting against the sheathing of the end walls.

The next step will be to put the tarred roofing-paper on the end walls, beginning at the bottom and covering it with the second layer of the sheathing which is nailed fast against it. The first or bottom board of this second course of sheathing should be only half as wide as the other boards, to secure the breaking of joints between the two courses.

After the end walls are finished the side walls are covered with the tarred paper and the finishing course of the sheathing. If the studs at the corners have been properly placed the ends of each course of the sheathing-boards can be nailed to bind all firmly together. The floor of the silo may be of cement, or wet puddled clay may be pounded down to make an impervious bottom.

A doorway will be required in the middle of one end wall of the silo for convenience in feeding out the silage. It should be wide enough to admit a truck, or box on wheels, for carting the silage, and it should extend from the sill to within two or three feet of the top of the silo wall. This doorway is best provided for when building the end wall, by leaving out the middle stud and spacing the others to leave the desired opening. When putting on the inside sheathing cut out pieces opposite this opening of suitable length for the ends to rest against the door jambs; and the door is built of these with an intermediate sheet of tarred paper, beginning at the bottom, as the silo is filled, the silage, by its pressure, holding them in place. When the silo is full, this door, if properly laid, should form as perfect a protection to the silage as any other part of the walls. When feeding out the silage the door-boards are removed in succession as required, beginning at the top.

If the silo is outside the barn, which, on the whole, is perhaps the most economical plan, a roof will be needed, and this should be at least three feet above the walls of the silo at the sides to secure head room for work in filling. This can be provided for by extending the balloon frame by means of $2 \times 4$ or $2 \times 6$-inch studs, three feet long, set on the plate at the top of the side walls, and on these a scantling may be spiked to serve as an upper plate to support the rafters.

If the silo is more than 16 feet long, a tie-beam, or truss, may be needed to prevent the walls from bulging out from the pressure of the silage. As a preservative, hot coal-tar or crude petroleum may be freely used on all of the scantling and boards used in the construction of the silo proper.

The inside of the silo may be finished with a coat of hot coal-tar, applied with a swab made by tying a piece of strong cloth to a stick, which serves as a handle.

**Fodder Corn.**—The importance of growing fodder corn so that it will fully mature and the objections to thick seeding have already been pointed out in speaking of corn as a forage crop. From the exaggerated claims that are frequently made in regard to the advantages of ensilage, it may, however, be well to call attention to the fact that we can only take from the silo that which has been put in it, and that success will largely depend upon the quality of the fodder put into the silo. The pale yellow, watery fodder corn that is grown when thick seeding is practiced is not a nutritious or desirable food for stock under any circumstances, and its value as food is not increased by running through a silo.

**Filling the Silo.**—Fodder corn has been stored in the silo as hauled from the field, and it may be preserved in that way, but it will be much better to cut it in about half-inch lengths by running it through a feed cutter, as it packs in the silo to better advantage and is more conveniently fed out. Every step in the process should be managed to economize labor, particularly in the feeding out of the silage, or the cost of handling the fodder in the green state may more than counterbalance the advantages that may otherwise be derived from it.

The system of rapid filling and thorough packing of the fodder by tramping as it is put in the silo that was formerly practiced, is now found to be unnecessary, and simpler methods are more effective.

It is well known that green fodder in loose piles will heat rapidly, and a temperature of over 130° is readily obtained. It is also known that the micro-organisms that cause the acid

fermentation of silage are killed at a temperature of from 122° to 125°, and that even a temperature of 115° to 120° materially checks their activity, and if continued for some time proves fatal. From these facts I was led to make the suggestion, several years ago, that the remedy for sour silage was to fill the silo loosely, without packing the fodder by tramping, so that the mass would heat to a point that would check the activity or prove fatal to the microbes of fermentation.

In a number of cases in which this method of filling the silo was practiced I was informed that a temperature of from 130° to 140°, and in several instances 150°, was observed in the silage, and all agreed that when a temperature of 125° was reached the silage was practically free from acidity. Within the past five or six years this method of filling the silo has been extensively practiced, with the most satisfactory results.

Care must be taken to completely fill the corners and sides of the silo, but any tramping of the fodder beyond what is required for this purpose should be avoided. Among the advantages of the method of slow filling may be mentioned the economy of labor, as the work can be done with the ordinary farm force; an improvement in the quality of the silage; and a gradual settling of the fodder so that the silo can be entirely filled.

Fermentation is less active in well-matured fodder corn than in that which contains a larger proportion of water, and the microbes of fermentation are more readily kept in check by the heating of the silage as the crop approaches maturity. It is, however, an error to assume that mature fodder corn will not ferment, as I have seen samples of very sour silage from well ripened corn.

**Cover and Weights.** — The tight plank covers and heavy weights that were so confidently urged as essential to success in the ensilage of green fodder, are now found to be unnecessary. It was observed that a few inches of the surface of the silage was often mouldy, even when tight covers and heavy weights were used, and the natural suggestion was made to cover the corn fodder with a layer of straw or marsh hay, or other coarse materials for the surface moulds to act on, and thus protect the more valuable fodder from their action. A covering of 12 to 20 inches of cut straw seems to be sufficient to protect the silage from moulds, and the weights that were formerly used are now almost entirely dispensed with. A few loose boards may be laid on the straw to keep it in place, but even these are not absolutely necessary.

**Loss of Nutritive Materials.** — In the curing of corn fodder by drying in the field, and in preserving it in the form of silage, there is undoubtedly a loss of nutritive materials that cannot be wholly avoided. The relative merits of the two methods of preserving fodder corn must, however, be measured by other considerations than the relative loss of nutritive materials, and it is difficult to lay down any rule of general application as to which is best, from the varying demands of different systems of management.

In many localities there is a difficulty in curing fodder corn by drying from the heavy fall rains or other atmospheric conditions, and a supply of green feed during the winter months may be desirable as a complementary adjunct of other foods, as in winter dairying. The advantages that may reasonably be claimed for the ensilage of fodder corn are as follows: it may be harvested and stored in the silo in an available form for feeding, whenever required, under atmospheric conditions that would seriously interfere with the curing of the crop by drying; it also furnishes a convenient supply of green feed to piece out and diversify the winter rations of stock, which is an important consideration when roots are not grown; and lastly, when the fodder is preserved in the silo it is in a convenient form for feeding, if suitable facilities are provided for handling it with economy in the expenditure of labor.

As a consistent part of a well-planned system of management the ensilage of fodder corn may be commended, but it cannot be relied upon as the one thing needed to ensure success in the complex business of farming.

## WHIPPLETREES AND DRAFT.

The double whippletrees, or eveners, * in common use are presumed to equalize the work performed by two or more horses when working together, but from defects in construction they often defeat the very purpose they are intended to serve.

The principle involved in the evener that really equalizes the draft, and the defects in the ordinary forms, will be readily understood from an examination of the following diagrams, which illustrate the effects on the draft of the different forms. For convenience in description the two pins at the ends of the evener are called the whippletree pins and the middle one the center-draft pin. Lines are drawn from the whippletree pins, on each side parallel to the line of draft, which is terminated with an arrow to indicate the direction of motion, and the distance of these side lines from the line of draft will serve as a measure of the leverage on each end of the evener.

1st, when the center-draft pin is in the same line with the whippletree pins, each horse will perform the same amount of work in any position of the evener.

This figure represents the proper form of the evener, the three draft pins being in the same line. When the evener is at right angles to the line of draft, as shown by the black lines, the side lines are the same distance from the line of draft, and the lines A and B are of equal length. When the position of the evener is changed, as indicated by the dotted lines, the whippletree pins are nearer the line of draft, but equally distant from it, the dotted lines C and D being likewise of equal length. With the draft pins in the same line the draft is equalized in whatever position the evener is placed. If one horse works ahead of the other, as is often the case, the relative leverage is the same, and each performs the same proportion of the work as when the evener is at right angles to the line of draft.

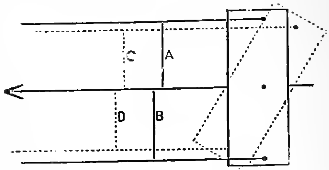

FIG. 9.

2d. When the center-draft pin is in front of the line drawn between the two whippletree pins, the horse that is *ahead* performs less than its share of the work.

The center-draft pin is here placed in front of the line connecting the two whippletree pins. In the position represented by the black lines the draft is equalized, the lines E and F being of equal length. With a change in the position of the evener, as shown by the dotted lines, the horse that is ahead performs less than its share of the work, its whippletree pin being further from the center-draft line, as the dotted line H is considerably longer than the dotted line G. With a double-whippletree of this form the quick, active horse that works a little in advance of its mate has the advantage in leverage and in the work performed, and can thus readily "wear out" its mate when moving heavy loads.

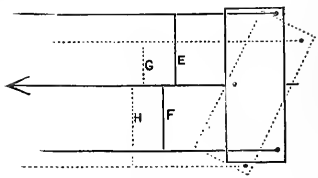

FIG. 10.

* What are perhaps more generally known in this country as double-whippletrees, or eveners, have a variety of names in different localities, as, "draught-bars," "swing-bars," "swing-trees," "whiffletrees," or "double-trees."

3d. When the center-draft pin is behind the line of the whippletree pins, the horse that lags *behind* does less than its share of the work.

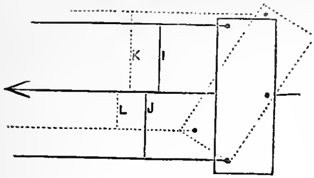


FIG. 11.

The center-draft pin in this figure is behind the line of the whippletree pins. As in Figures 9 and 10, the black lines show that the work is equalized when the evener is at right angles to the line of draft, the lines I and J being equal.

When the evener is changed to the position represented by the dotted lines the horse that falls behind has the advantage in leverage, and does less than half the work, the dotted line K being longer than the dotted line L. With this form of the double whippletree the free horse that keeps ahead would be "worn out" by an easy-going mate that was disposed to shirk in doing heavy work.

It is sometimes found desirable to give a young horse an "advantage," as it is termed, by placing the whippletree pin of its stronger mate nearer the line of draft, and this suggests the following proposition:

4th. When an "advantage" is given to one horse by placing the whippletree pin of its mate nearer the line of draft, the desired effect will not be secured unless the three draft pins are in the same line.

This will be seen from an example with an evener of the form of Figure 10, with the center-draft pin in front of the line of the whippletree pins, as in Figure 12.

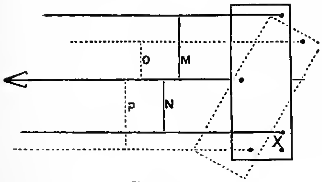


FIG. 12.

As the length of the lines M and N represent the respective distance of the whippletree pins from the central line of draft with the evener in the position represented by the black lines, the horse working on the long arm M would do less than half the work, as intended.

If the *short end* of the evener (marked X) moves forward, the proportion of the work done by the horse drawing from X is constantly diminishing, until, in the position of the dotted lines, it is doing less than one-half of the work, the dotted line P being longer than the line O — the reverse of what was intended. In a position of the evener between the two positions represented in the diagram, the work performed by each horse would be equal, the proposed "advantage" being lost.

If the *long end* of the evener is moved forward the reverse effect will be produced, the *advantage* given the horse in the first position will be increased, and it would then do less than its intended share of the work.

With the form of evener represented in Fig. 11, the effect of a proposed advantage would, as a matter of course, be reversed.

The following examples of common forms of double whippletrees are from actual measurements:

On omnibuses, length 48 inches, center-draft pin 4 inches behind the line of the whippletree pins.

Farm "eveners," for sale at the implement stores, 40 inches long, center-draft pin $3\frac{1}{4}$ inches in front of the proper line.

Mower No. 1. — 32 inches long; center-draft pin $2\frac{1}{4}$ inches out of line.

Mower No. 2. — 34 inches long; center-draft pin 3 inches out of line.

Mower No. 3. — 34 inches long; center-draft pin $4\frac{1}{2}$ inches out of line.

Mower No. 4. — 29 inches long; center-draft pin 5 inches out of line.

The length of the evener is in all cases from center to center of the whippletree pins.

In the case of the last-mentioned mower, if one end of the evener is 4 inches in advance of the other end, a variation that is not unusual, the horse that is ahead would be working on the arm of a lever 12.7 inches long, and the horse falling behind on an arm 15.3 inches long. The rear horse would therefore have an advantage in leverage of 2.6 inches.

Taking the draft of a mower at 200 pounds, which is about the average of the New York trials, the forward horse would be drawing 109.3 pounds, and its mate 90.7 pounds, a difference of nearly 19 pounds, or almost ten per cent. of the load.

The significance of this difference in the work performed by two horses will be seen by reference to the estimates of engineers of the efficiency of a horse when working ten hours a day. According to Wood an ordinary horse is capable of exerting a traction force of 125 pounds when moving at the rate of two miles an hour, 83 pounds at the rate of 3 miles an hour, 62 pounds at the rate of 4 miles an honr, 50 pounds at 5 miles an hour, 42 pounds at 6 miles an hour, 36 pounds at 7 miles an hour, and 31 pounds at 8 miles an hour. "As the speed of a horse increases his power of draft diminishes very rapidly till at last he can only move his own weight." As the speed increases the hours of work per day must be diminished to prevent exhaustion.

From the New York plow trials a fair average of the draft of two-horse plows may be taken at 350 pounds, or 175 pounds for each horse. The average draft of both mowers and plows, it will be seen, considerably exceeds the engineer's estimate of the power of an average horse, moving at the rate of 3 or 4 miles an hour, when working ten hours a day.

A common form of evener used in ploughing is given in the following figure.

Fig. 13.

We have here the form illustrated in Fig. 11. In ploughing with a total draft of 350 pounds, with the evener as usually proportioned, if one end is 4 inches in advance of the other, the difference in leverage would be 1.5 inches, the forward horse exerting a force of 181.6 pounds, and the horse falling behind 168.4 pounds, a difference of over 13 pounds, which, under the circumstances, is really of greater importance than 20 pounds with the mower of lighter draft.

Fig. 14.

In this form the bands are intended to utilize the full strength of the timber. It, however, throws the points of draft still further out of line, and it will be less efficient in equalizing draft than that represented in Fig. 13, when not at right angles to the line of draft.

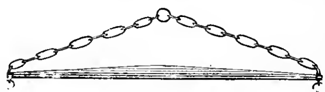

Fig. 15.

Eveners of iron straps in the form of a truss or made with a rod and chain, as in Fig. 15, are decidedly objectionable, as the centre draft ring is frequently 7 or 8 inches from the proper line, and when not exactly at right angles to the line of motion the resulting inequality in draft will more than counterbalance any desirable qualities they may otherwise have.

In heavy draft the importance of equalizing the work performed, in all positions of the evener, by placing the draft-pins in the same line, cannot be too strongly urged, as differences in traction of but a few pounds represent a significant percentage of the work a horse is capable of doing without injury, when working ten hours a day for a considerable length of time.

## Trotting Records.

In the evolution of the trotting horse notable progress has been made, and the phenomenal record of 2.14 by Goldsmith's Maid in 1874 has now been lowered several seconds by a number of trotters, and among them are two at the age of three years. In 1889 over 600 horses entered the 2.30 list, and of these over 100 were placed in the 2.25 class, and 15 made 2.20 and better. At the close of 1890 there were 4,614 trotters in the 2.30 list, of which 383 were in the 2.20 class, and 33 were 2.15 or better.

From the number now in the 2.20 list we can only notice some of the most remarkable records, with a list of those beating the time of Goldsmith's Maid.

| | |
|---|---|
| $2.08\frac{3}{4}$. | Maud S., by Harold. |
| 2.10. | Jay-Eye-See, by Dictator. |
| $2.10\frac{1}{2}$. | Sunol, by Electioneer. |
| $2.10\frac{3}{4}$. | Guy, by Kentucky Prince. |
| $2.10\frac{3}{4}$. | Nelson, by Young Rolfe. |
| 2.11. | Stamboul, by Sultan. |
| 2.11. | Allerton, by Jay Bird. |
| $2.11\frac{1}{4}$. | St. Julien, by Volunteer. |
| $2.11\frac{3}{4}$. | Nancy Hanks, by Happy Medium. |
| 2.12. | Axtell, by William L. |
| $2.12\frac{1}{4}$. | Palo Alto, by Electioneer. |
| $2.12\frac{3}{4}$. | Belle Hamlin, by Almont, Jr. |
| $2.13\frac{1}{4}$. | Rarus, by Conklin's Abdallah. |
| | Maxey Cobb, by Happy Medium. |
| $2.13\frac{1}{2}$. | Harry Wilkes, by George Wilkes. |
| $2.13\frac{3}{4}$. | Phallas, by Dictator. |

This list of celebrities is remarkable not only for the number making a record below 2.14, but from the fact that it is so largely made up of the direct descendants of a single stallion. Rysdyk's Hambletonian is grandsire of ten of the list, nine having been got by six of his sons, and the dam of another is his daughter, while others claim a relationship but little more distant.

The six sons of Hambletonian directly represented here are sires of 249 in the 2.30 list, and 38 in the 2.20 list, and 33 of their get entered the 2.30 list in 1889. Hambletonian is the sire of 41 and the grandsire of 580 in the 2.30 list, and it is claimed that over 1,000 of his descendants in the male line have records of $2.08\frac{3}{4}$ to 2.30.

### YEARLING RECORDS.

Freedom (stallion), by Sable Wilkes, $2.29\frac{3}{4}$.
Norlaine (filly), by Norval, $2.31\frac{1}{2}$.
Faustino (stallion), by Sidney, 2.35.

### TWO-YEAR-OLD RECORDS.

Sunol (filly), by Electioneer, 2.18.

Regal Wilkes (stallion), by Guy Wilkes, $2.20\frac{3}{4}$.

Guy Wilkes is full brother to the sire of Axtell.

Wildflower, by Electioneer, 2.21.
Fred Crocker, by Electioneer, $2.25\frac{1}{4}$.
Sweetheart, by Sultan, $2.26\frac{1}{2}$.
Ralph Wilkes, by Red Wilkes, $2.26\frac{3}{4}$.

### THREE-YEAR-OLD RECORDS.

Sunol, by Electioneer, $2.10\frac{1}{2}$.
Axtell, by William L., 2.12.
Sable Wilkes, by Guy Wilkes, 2.18.
Bell Boy, by Electioneer, $2.19\frac{1}{4}$.

### FOUR-YEAR-OLD RECORD.

Manzanita, by Electioneer, 2.16.
Edgemark, by Victor Bismarck, 2.16.

### FIVE-YEAR-OLD RECORD.

Jay-Eye-See, by Dictator, $2.10\frac{3}{4}$.

### TROTTING DOUBLE TEAMS.

Maud S. and Aldine, $2.15\frac{1}{2}$.
Aubine and Lady Wellington, $2.15\frac{1}{2}$.
Maxey Cobb and Neta Medium, $2.15\frac{3}{4}$.

### PACING.

One hundred and fifty-seven pacers entered the 2.30 list in 1889, and of these 55 are classed at 2.25; 15 at 2.20, and two at 2.15. At the close of 1890 there were 1,251 pacers in the 2.30 list, of which 237 were classed as 2.20; and 50 as 2.15 or better. The best pacing records are as follows:

Johnston, $2.06\frac{1}{4}$.
Roy Wilkes, $2.08\frac{1}{4}$.
Direct, $2.09\frac{1}{4}$.
Hal Pointer, $2.09\frac{3}{4}$.
Gold Leaf, $2.11\frac{1}{4}$.
Dallas, $2.11\frac{1}{2}$.
Little Brown Jug, $2.11\frac{3}{4}$.
Manager (3-year-old-stallion), $2.11\frac{3}{4}$.
Sleepy Tom, $2.12\frac{1}{4}$.
Buffalo Girl, $2.12\frac{1}{2}$.
Richball, $2.12\frac{1}{2}$.
Brown Hal. $2.12\frac{1}{2}$.
Mattie Hunter, $2.12\frac{3}{4}$.

Twenty-five years ago the best trotting record was that of Flora Temple, $2.19\frac{3}{4}$, made in 1859; and the best pacing record was that of Pocahontas, $2.17\frac{1}{2}$, made in 1855.

Of the notable prices paid for trotters may be mentioned Axtell, \$105,000; Bell Boy, \$51,000; Stamboul, \$50,000; and Sunol, \$45,000. A Michigan bred horse, Jerome Eddy, by Louis Napoleon, was sold in 1883 for \$25,000, the highest price made at that time.

Since the above was in type, Allerton has lowered the stallion record to 2.10, and Direct has lowered the pacing record to 2.06.